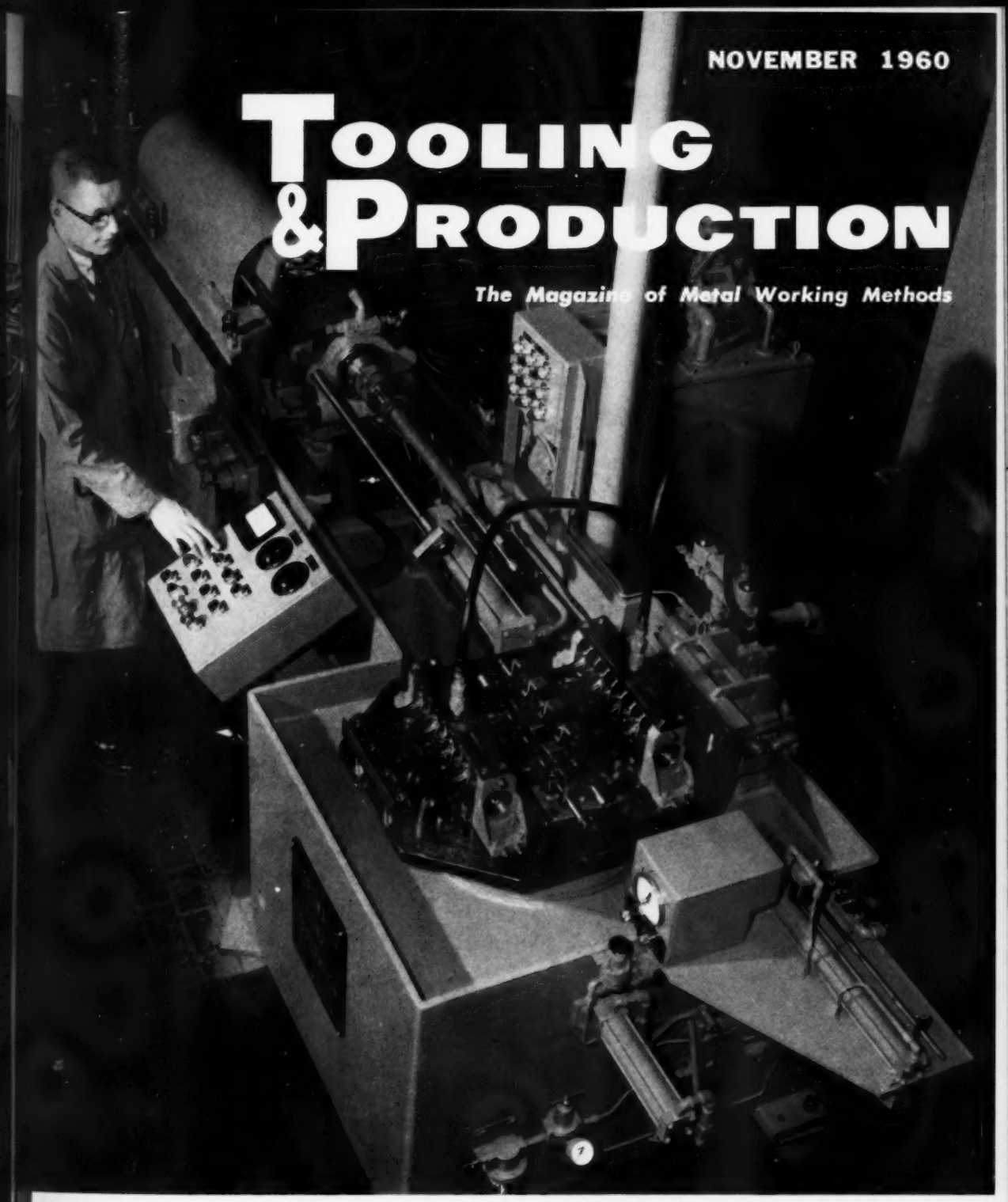
NOVEMBER 1960

TOOLING & PRODUCTION

The Magazine of Metal Working Methods



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2 Temper and Tension
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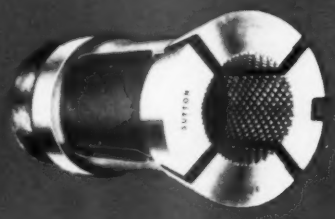

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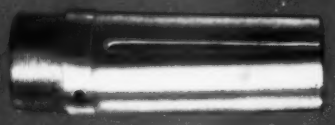

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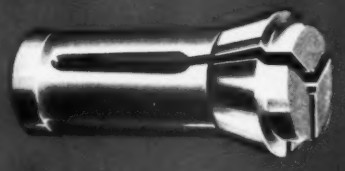

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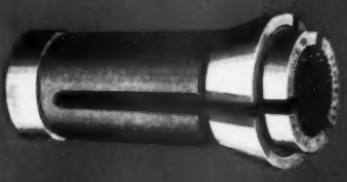

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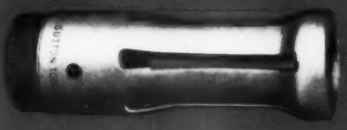

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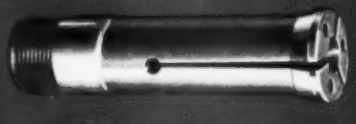

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TOOLING & PRODUCTION Magazine

VOL. XXVI, No. 8

NOVEMBER 1960

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Form 3579 requested. Send to Editorial and Business Offices: 1975 Lee Road, Cleveland 18, Ohio. Accepted as a Controlled Circulation Publication at Shepherdsville, Ky. Single copies, $1.00 each. U. S. subscription rate $2.00, per year for metalworking plant operating executives and department heads. All other subscriptions, $6.50 per year. Foreign subscriptions, $10.00 per year.

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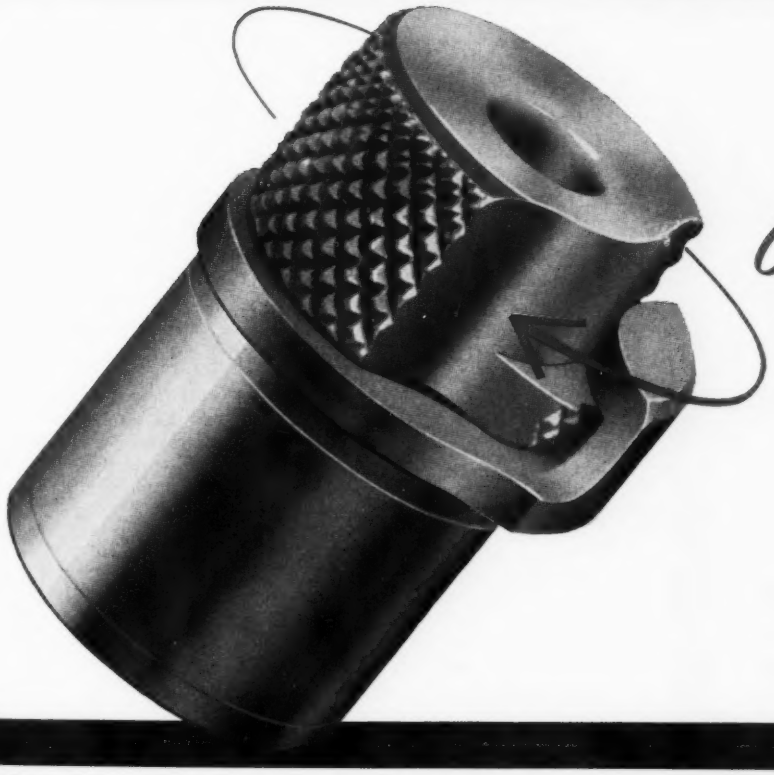

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NOVEMBER 1960
VOL. XXVI, No. 8
GEORGE J. HUEBNER, Founder
1885 - 1956

personally speaking...

Dear T & P Reader:

When this issue of Tooling & Production reaches you there will be still a couple of months to go before 1960 is history. But, if you are in any kind of a situation like we are, you will be thinking very seriously of what 1961 has in store for you and for our country.

There is a continual flow of prognostications at almost any time. And the chances are you can find some that agree with your thinking regardless of whether you are optimistic or pessimistic. My observation has been that there is rather considerable feeling on the part of students of future trends that 1961 will end up being about like 1960, volumewise. Most predictions are for a slight decline in business the first six months with a little pick up the last six months, finally making the year about like 1960.

If this is true, then the predictions of fierce competition in 1961 are probably quite accurate because almost invariably there is rough price competition when business volume remains steady. Similarly, there is an easing of competition any time that our economy is expanding and demand is increasing.

All of this leads me to the suggestion that I want to make. It's axiomatic, of course, that manufacturing managers can enormously influence net profits under conditions such as we appear to be able to look forward to in 1961. Every time you save a half cent per piece on a run of 50,000 pieces, you contribute a potential $250.00 to net profit. There are many plants in the United States that can effect economies through spending a few dollars on new machines or equipment or modern devices of various kinds that are available.

Tooling & Production will be full of cost-saving ideas in these next few months in both its editorial columns and the advertisements that it will expose to you. May I urge your most thoughtful consideration of every possible means of refining production operation to effect these very modest savings which can so greatly help the over-all picture in many, many companies.

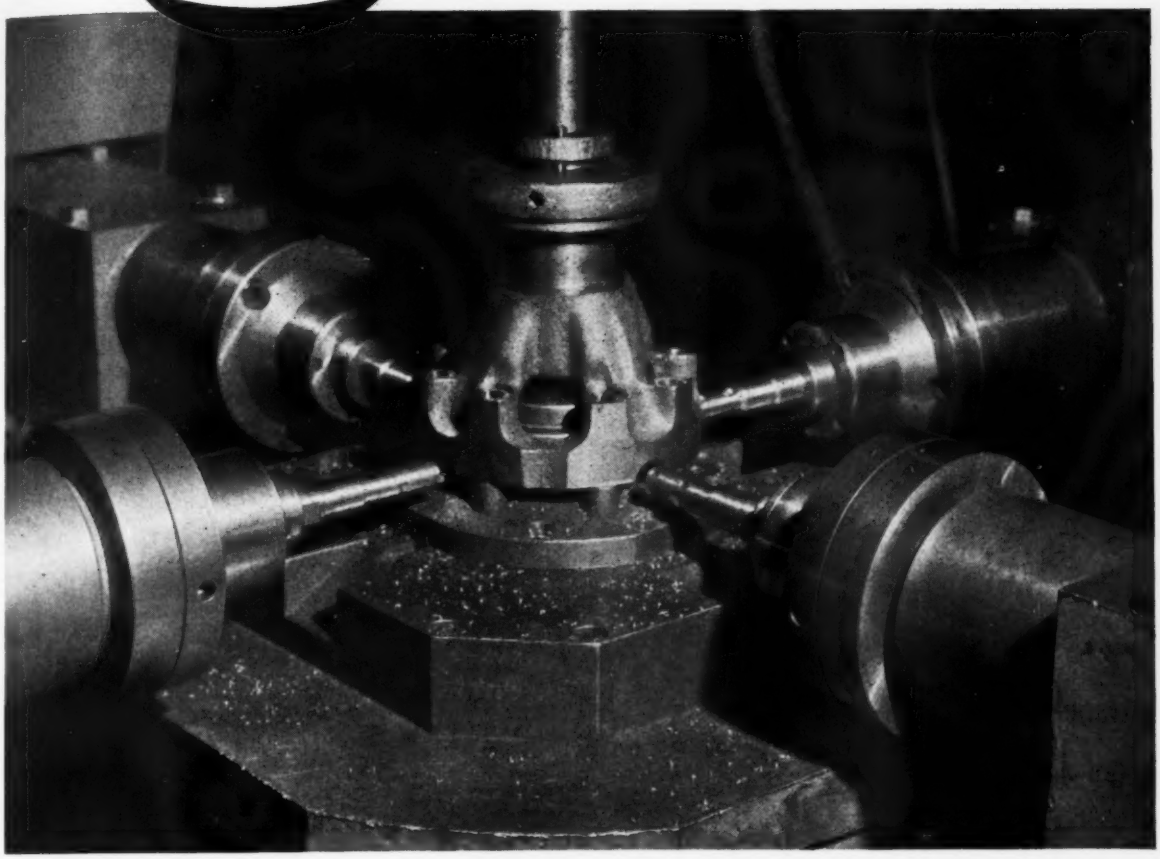
Last month, I made quite a few comments about "Echo." And then, of course, it promptly went out of sight for us in the United States. If you've been checking its progress, though, you, too, probably are aware that it is going over now during daylight hours so it is only visible with special instruments. I understand, though, if we have patience we'll again be watching it cross the night sky. And if you have never seen it, I recommend that you try and spot it sometime. It's easy to see and it's a thrilling sight.

Cordially yours,

Ray Huebner

Publisher

VR-65 Tungsten-Free Carbide



4 times more production!

The job is rough and finish boring half holes in a C5 steel forging. The machine is a 4 way Cross Bore operating at a speed of 2360 rpm and 700 sfpm; with a feed of .005 and a .025 to .030 depth of cut.

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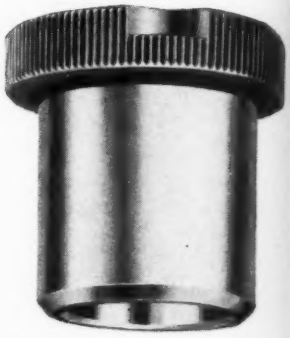

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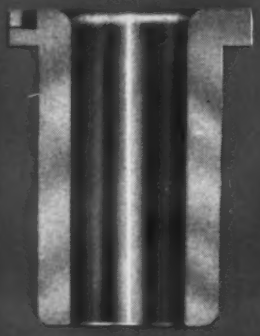

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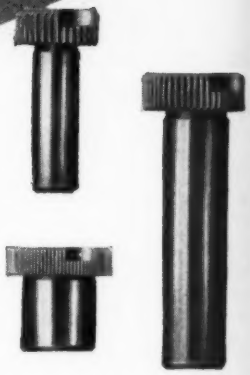

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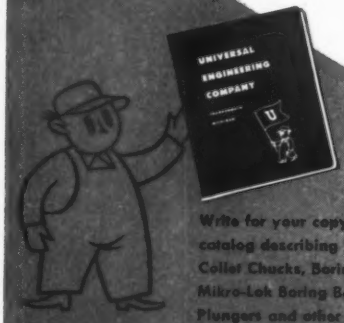

Write for your copy of our new 98 page catalog describing Standard Collet Chucks, Floating Collet Chucks, Boring Chucks, "Kwik-Switch" Tool Holders, Mikro-Lok Boring Bars, Standard Drill Bushings, Universal Index Plungers and other Universal products.

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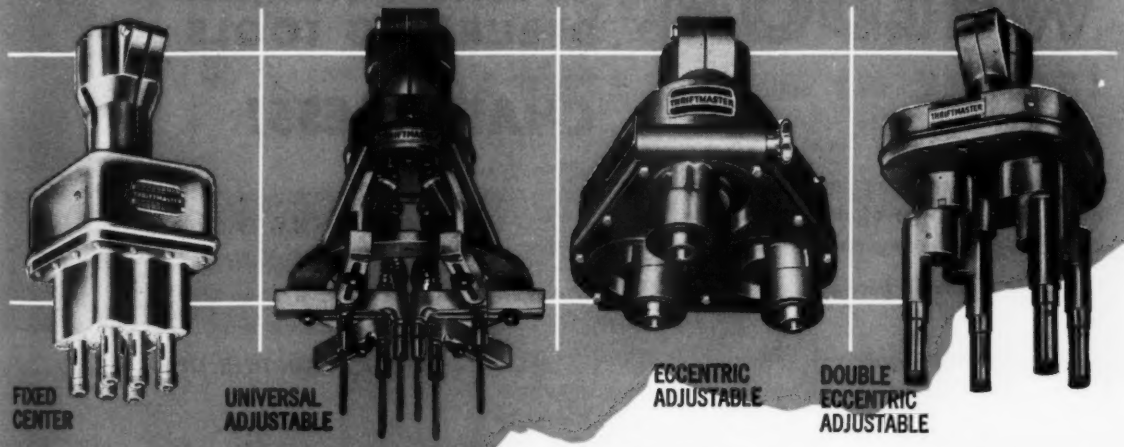

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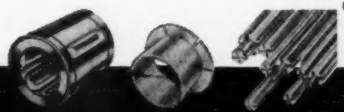

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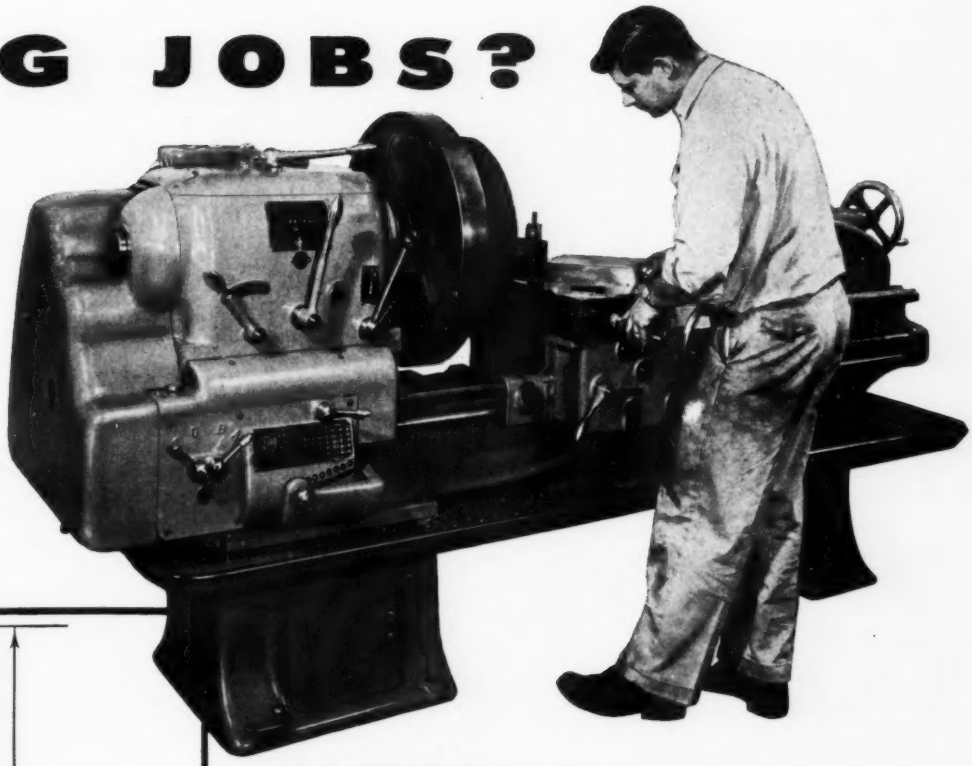

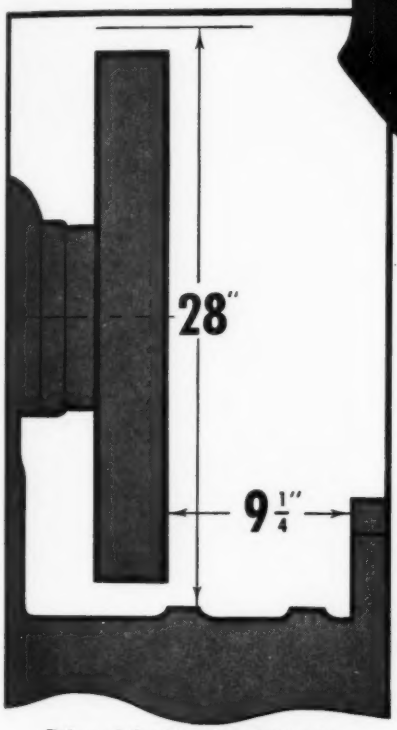

CLAUSING COLCHESTER GAP BED LATHES' EXTRA CAPACITY HANDLES THEM IN STRIDE!

You get the needed capacity to handle those BIG jobs simply by removing the bed segment of this Clausing 17" gap bed lathe. Note the swing in gap—28". And the length of gap in front of face plate—9¼". Here, *for sure*, is a heavy duty, precision lathe that handles your big diameter work . . . in stride! Now, check its other "BIG CAPACITY" features:

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- **Totally enclosed head and quick-change gear box, oil bath lubrication.**
- **Big L-2 taper spindle, hardened and ground.**
- **Large, Gamet tapered roller bearings with oil flow lubrication.**
- **Induction-hardened, precision ground bed ways.**
- **Separate rod for power feeds.**
- **Precision construction throughout to equal or surpass American standards of toolroom lathe accuracy. For example, each lathe is *factory-checked to turn round within .0001".***

Prices of the Clausing-Colchester 17" gap bed models, including 2-speed motor and Allen-Bradley controls, start at $5100; 13" at $2555 and 15" at $3580. Straight bed and profiling models also available. Write for complete information today.

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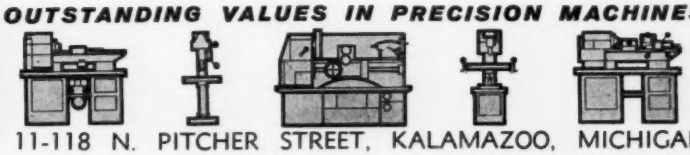
OUTSTANDING VALUES IN PRECISION MACHINES



11-118 N. PITCHER STREET, KALAMAZOO, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 9

Precision lathes for tape, tracer, or operator control

Here you see the core of the new Barber-Colman lathe line. To prove the *new* ideas claim, take just two examples, the Tape-r-guide (directly below) and the 1610 tracer lathe (lower right, opposite page).

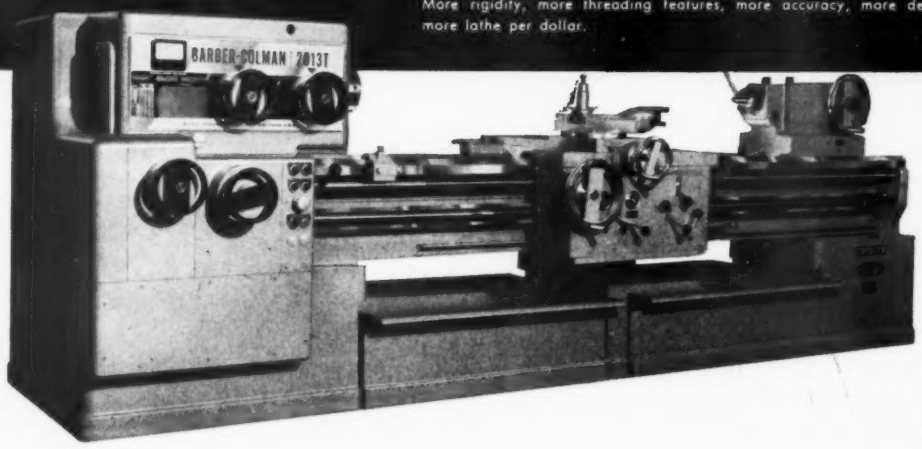
News about the Tape-r-guide? Without complex electronics, with just electromechanical controls, this machine can do cutoff and boring as well as internal and external step-turning, smooth tapers, and even some radii. Simplicity itself, it does its work with a single-point tool...

The new ideas in turning

new

NEW Tape-r-guide (16" and 20"). First basically mechanical lathe with fully integrated 8-channel binary code control system. Automatically performs stop-start, positioning, speed adjustment, and feed change functions; machines all practical tapers without "hunting" or step formation; produces simple radii; cuts chamfers without special tools; performs cutoff and boring operations and machines at 90° to the work axis — all without feedback or complex electronics. Low capital equipment investment — simple, low-cost operation and maintenance.

NEW 2013, 36-speed lathe (21" and 25") — All-new, geared-head precision lathe for high-speed production or toolroom turning . . . used in production shops with throw-away insert tools at speeds up to 750 sfpm. For fast, accurate production of medium- and short-run jobs. Spindle speeds to 1500 rpm (1200 rpm optional); 66 thread cutting and feed changes; 400-lb, two-speed tailstock; separate lead screw and feed shaft. More rigidity, more threading features, more accuracy, more design refinements — more lathe per dollar.



new

completely controlled by the tape. And about the 1610 tracer? This is the "specialist," a concept which for the first time strips off the toolroom equipment and offers a facing and turning lathe that is frankly a production tool. Tracer control multiplies its productivity by making it semiautomatic.

Both these new machines are innovations, and are signs of the unencumbered thinking that goes on at Barber-Colman. It is part of the heritage that has brought to Barber-Colman precision lathes such important design advantages as sealed gearboxes, controls that are simplified and grouped, hardened and ground bedways, the use of precision antifriction bearings, and universal automatic lubrication.

You can continue to expect significant design contributions such as these in the lathes Barber-Colman will build in the years to come. But meantime, take advantage of the increased productivity of the machines offered today.

A good way to start is to call your Barber-Colman representative.

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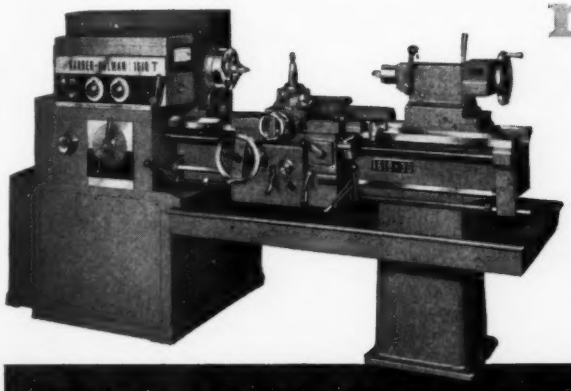

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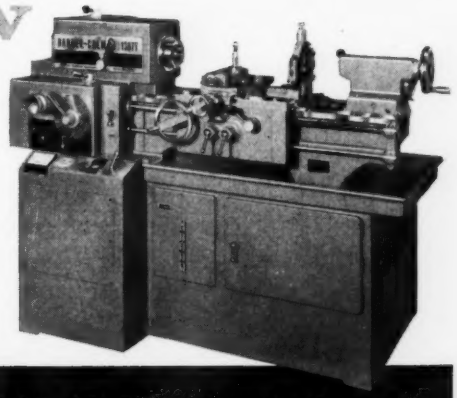


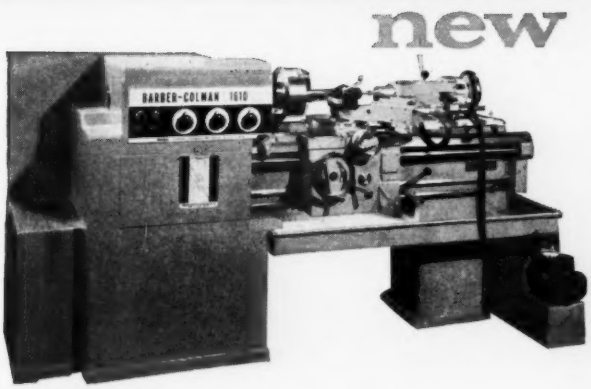
NEW 1610T toolroom lathe (16½" and 20") — The lathe with the "toolroom touch." The minute you push the start button and grab the handwheel, you feel the difference toolmakers look for. Try the speed change dial for fast facing or a light finishing cut on the OD. Smooth, silent, fast acceleration under load — infinitely variable speeds to 1500 rpm in the high range.

NEW 1610 specialist (16½" and 20") — Proven new concept reduces both capital equipment and operating costs. For high-speed turning, facing, and boring. Class B operators readily become proficient at producing accurate nonthreaded parts up to 100% faster. Infinitely variable spindle speeds to 1500 rpm; infinitely variable power feed to both carriage and cross slide; five-position turret-type longitudinal feed stop — reduces skill requirements and speeds operation.

NEW 1307T toolroom lathe (13") — High capacity and timesaving controls combined with super precision. Infinitely variable speeds to 3000 rpm in belt drive can be changed under load. Combines extra capacities (13" swing and 24" between centers) with extra quality: selected Class ABEC-7 super-precision spindle bearings; ground-from-the-solid actuating screws; antifriction bearings on all shafts; Meehanite castings; hardened-and-ground headstock gears, splined shaft connections.

NEW 1610 tracer lathe (and 1610-13) — Can be purchased with hydraulic tracer for about the same price as a toolroom lathe of the same rated capacity and quality. Real cost-busting combination of "specialist" lathe and tracer control capable of holding diameters within 0.001".

new



new

CIRCLE INFORM-A-GRAM KEY NO. 11

The new Vertical Illuminator and the AO Spencer Cycloptic Stereoscopic Microscope make a unique team that can be the answer to your problem whether it's the inspection of detail in small diameter, deep hole borings, or delicate assembly of miniaturized parts where every move is critical.

This low-cost illuminator readily attaches to the Cycloptic to provide efficient, shadowless illumination deep inside small orifices...and the Cycloptic delivers realistic, erect, true three-dimensional magnification of the illuminated detail.

The remarkable long working distance afforded by Cycloptic (up to 7 inches when Vertical Illuminator is used with 53 and 59 Series) gives you *plus* advantages... permits ample room for large size objects or inspection and assembly tools.

Add this unit to your present Cycloptic or ask about low-cost Vertical Illuminator and Cycloptic stereoscopic microscope combinations.

American Optical Company
INSTRUMENT DIVISION, BUFFALO 15, NEW YORK

Dept. M179

Please send me FULL INFORMATION on the NEW AO SPENCER VERTICAL ILLUMINATOR AND CYCLOPTIC MICROSCOPES.

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ADDRESS_____

CITY_____ ZONE____ STATE_____

CIRCLE INFORM-A-GRAM KEY NO. 12

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Talk of the Month

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

NEW HORIZONS For Tomorrow's Engineering

by Ralph A. Fuller

Mr. Fuller is a Division Engineer with the E. I. du Pont de Nemours & Co., Inc. The talk excerpted here was presented at the Eleventh Annual National Conference of the American Institute of Industrial Engineers in Dallas, Texas.

AS ENGINEERS the future is our business. It takes just this philosophy to assure us the new products and processes so vital to the expanding economy of the years ahead. The future requires a technology constantly expanding in versatility that brings advantages to each succeeding generation.

Industrial Engineering has contributed greatly with impressive gains for enriching man's life and easing his burden. The Industrial Engineer offers the means by which impressive progress can be made and I am proud to participate in your conference with its thought-provoking theme, "The '60's — A Challenge to Industrial Engineering."

I view the '60's as the foundation, for the 15 and 50 years beyond. How well we design and lay this foundation will decide our way of life. But the fruit of test tube success cannot benefit unto itself. It takes engineering to make the results of research available for sale in the market place.

Large research outlays will lead to technological breakthroughs not dreamed of today in electronics, metallurgy, chemistry and power

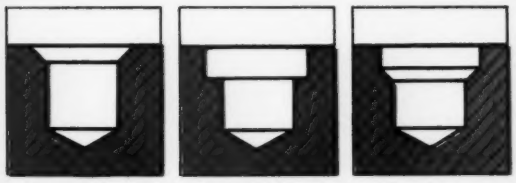
. . . **Continued on page 16**

YOU'LL WANT TO KNOW MORE ABOUT MOHAWK STANDARD SUBLAND DRILLS

Want to *eliminate* tap breakage, burring, jig and fixture movement, time and valuable part losses?

Mohawk Standard Drill-Chamfer sublands can do just that for you—plus, the obvious benefit of clean, concentric chamfered holes that will speed tapping operations, increase tap life, improve accuracy and lower both drilling, tapping and scrap costs. Yes, these "standards" drill and chamfer simultaneously. They're faster, infinitely accurate, they outlast *ordinary* tools and remain positively concentric through repeated regrinds.

And—they're easy to select for any job, because Mohawk (and their distributors) stock all practical sizes in 3 step lengths and 3 shank styles for immediate deliveries.



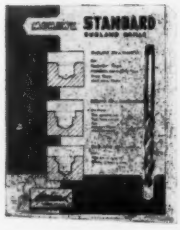
Subland Drill-Chamfer for Regular Taps Fluteless Taps Pipe Taps Heli-Coil® Taps

Subland Drill Counterbore for Socket Head Cap Screws

Subland Drill-Drill for Tap Drill and Body Clearance

Remember, too— Mohawk Standard Sublands are also immediately available in Drill-Counterbore and Drill-Drill types—in all practical sizes, step lengths and shank styles.

Mohawk
TOOLS, Inc.
Montpelier, Ohio



Write... Wire... Phone... for full information on the complete line of Mohawk Standard Subland Drills. Catalogued for your convenience.

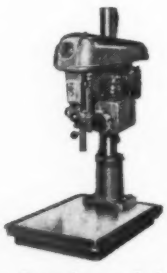
CIRCLE INFORM-A-GRAM KEY NO. 13

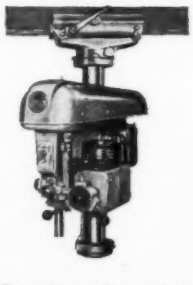
NEVER BEFORE—UP FRONT CONTROL WITH ONE HAND OPERATION

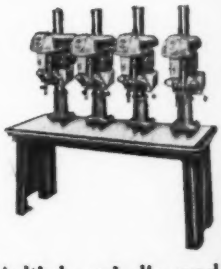
Unique pilot wheel control is mechanically integrated with the clutch control, allows operator to engage power feed with a simple wrist movement of one hand. Without any adjustments, operator can use rapid manual approach then power feed, skip drilling technique, straight power feed or straight manual feed. There are four feed ratios—.004, .006, .009 and .012 ipr—with each of five available spindle speeds.

NEVER BEFORE—SUCH A COMPLETE CHOICE OF MODELS

Floor model


Bench model

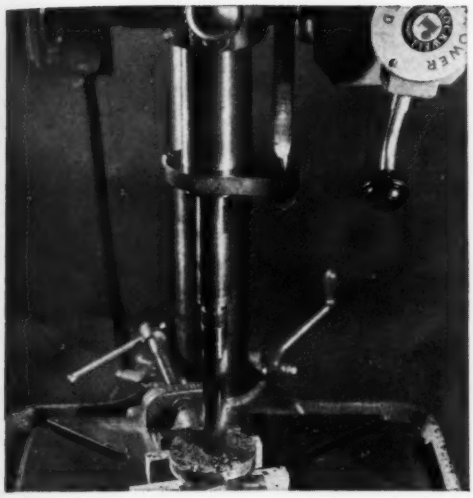

Overhead model


Multiple spindle model

ROCKWELL ANNOUNCES . . .

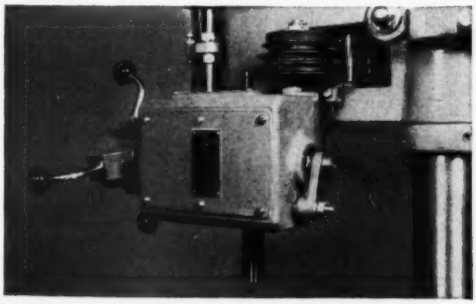
NEW POWER FEED

on famous DELTA 20" drill presses



NEVER BEFORE—"JOB TAILORED" DRILL POINT PRESSURE

A lathe-type cone clutch enables operator to adjust drill point pressure from 0 to maximum capacity of machine to permit power feeding on a production basis through a wide range of hole diameters. It furnishes power and thrust for drilling holes up to 1", yet delicately handles drills down to 1/16" diameter. Torque sensitive adjustability feature stops feed when overloaded—avoids drill breakage.



NEVER BEFORE—REMOTE CONTROL AND AUTOMATION

Actuating plunger, an extension of the clutch shaft, permits remote control which frees operator from manual effort. The power feed can be electrically, hydraulically, pneumatically, or mechanically interlocked with other machines or synchronized with devices such as rotary tables, clamps and work feeds for semi or full automatic operations.

Now Delta brings you advantages NEVER BEFORE AVAILABLE on a standard drill press—with the most advanced development in mechanical power feeds. Every model in the new Delta 20" drill press line offers power feed that gives you: *a front mounted pilot wheel for effortless one hand operation; infinitely adjustable drill point pressure; built-in feature that permits remote control or interlocking with automation devices.*

With the flexibility of feeds afforded by "flick of the wrist" control, operator's work is limited to loading, unloading, and actuating the tool. You get the adaptability of a power tool with the ruggedness, precision and capacity of a machine tool. Capable of handling production metalworking jobs done by machines costing much more, these new Delta power feed drill presses provide a simple, low cost method of increasing productivity and improving drilling quality.

Thoroughly tested through a rugged trial of 750,000 drilling cycles, Delta's new power feed line offers many other outstanding features and NEVER BEFORE AVAILABLE benefits that you cannot appreciate unless you see them demonstrated IN ACTION. Let your Delta Industrial Distributor show you how the 20" power feed drill press can help you cut costs (he's listed under "TOOLS" or "MACHINERY" in the Yellow Pages). Meanwhile, for FREE brochure giving details and specifications *plus* information on how to add New Power Feed to your present Delta 20" drill press, write: Rockwell Manufacturing Company, Delta Power Tool Division, 622L N. Lexington Avenue, Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Box 420, Guelph, Ontario.

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

CIRCLE INFORM-A-GRAM KEY NO. 15

. . . **Month's Talk from page 12**

generation. Markets may spring up overnight, and today's powerful markets will fall in the wake of scientific and technological innovations.

No forecast of course, can be more than a statement of probabilities for the future has to be earned. In this light, I will outline an eleven point program to improve the effectiveness of an engineering operation. I will cover some broad concepts, some specific ideas and some applications. I will indicate areas in which I believe new and greater emphasis must be applied to meet the known and unknown challenges of the future. It is through the exchange of know-how, such as we are experiencing here that we enhance and fire up inspiration.

To understand the scope and application of the eleven point program, a brief description of the Du Pont Engineering Department should be helpful.

It is divided into five divisions: namely, Design, Construction, Engineering, Consultants, Development Engineering, and Control Accounting and Cost Estimating. It makes available its latest developments in the field of engineering to all units of the Company.

Highlighting our discussion today, this division has the responsibility of all phases of design for new facilities. Its scope ranges from the gathering and evaluation of basic engineering data and procurement of major equipment, to the working drawings and specifications.

The consultant and Development Section provides solutions to unusual engineering problems and investigates advanced techniques.

The Management Service Section is responsible for subcontractor design and drafting, over-all coordination of project scheduling, costs and cost reduction, improved methods, and development and distribution of engineering standards.

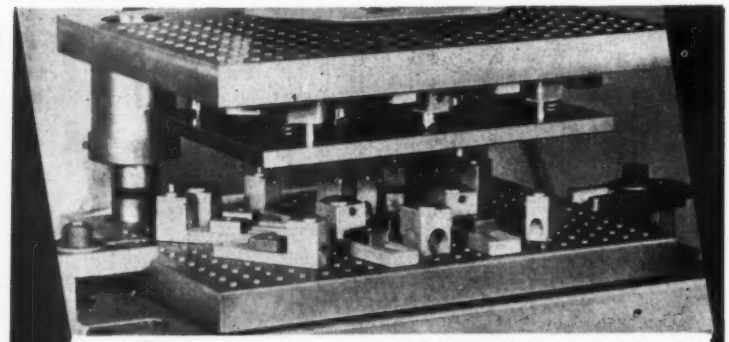
Design's major role is to reduce to practice, in the form of profit, most of the research data that is turned out by about 2200 technically trained people.

The people are a design force that must have imagination and drive to create new methods and skills, to use facts and logic to apply the engineered approach in transforming research into the tangibles of profit making facilities. They must have a distinct capability for innovation.

They must work in an environment that fosters creativeness, imagination and initiative. If we are tough-minded, aggressive design engineers will produce results. The eleven point program I will discuss is essential to the existence of this environment.

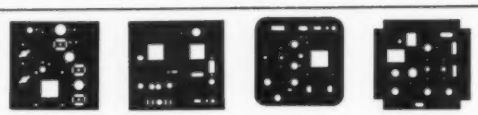
To reduce time from conception of an idea to its use, we telescope the research, design, construction and production phases of project work. Both the technical effort and its scheduling must be constantly evaluated during the design phase and very close liaison and careful follow-up are required if time is to be reduced. This is accomplished by using all sorts of devices and well-known practices.

. . . **Continued on page 18**



Punch Multiple Holes in One Operation with REUSABLE

DI-ACRO ADJUSTABLE PUNCHES AND DIES



Di-Acro Adjustable Punches and Dies offer you an inexpensive means of rapid tooling for multiple punching of holes of a variety of shapes and sizes. They will do the job in a fraction of the time it would take using a single station punch press and at a fraction of the cost of standard tooling. All tooling can be arranged in a countless number of patterns so that most multiple hole punching jobs can be accomplished in one operation. Tooling can be reused again and again. Holes can be as close together as $\frac{3}{4}$" on centers. A template locates your punches and dies accurately. Di-Acro punches and dies are concentric, readily interchangeable. Standard rounds, squares, rectangles, ovals, D's and other shapes in a variety of sizes are available from stock.

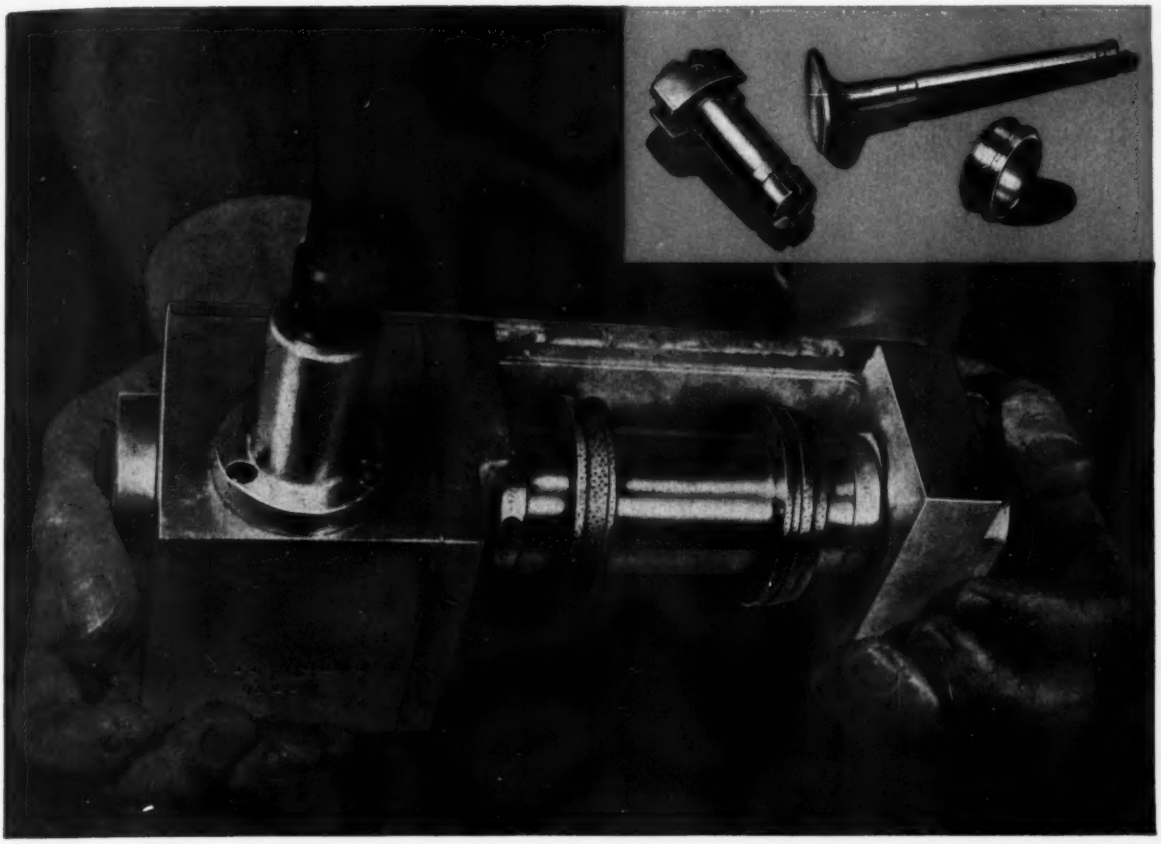
di-acro PRECISION METALWORKING EQUIPMENT

Pronounced die-ack-ro

Di-Acro Adjustable Punch and Die catalog is complete with detailed instructions and prices on all die sets, punches and dies. Consult the yellow pages of your phone book for the name of your nearest Di-Acro Distributor or write us for your free copy.

O'NEIL-IRWIN MFG. CO. 315 Eighth Ave., Lake City, Minn.

CIRCLE INFORM-A-GRAM KEY NO. 16



THIS TRU-GRIT® ROTARY DIAMOND DRESSING WHEEL forms grinding wheels with speed, accuracy and economy unapproached by any other method

It form dresses ANY grinding wheel—vitrified, resinoid, silicate, rubber or shellac bond. It has none of the limitations of crusher roll or single point diamond tool forming; it develops complex configurations and sharp, deep, square grooves with absolute accuracy, assuring exact reproduction in the work piece. It may do this in a single, quick pass between ejection and loading, without interrupting the production cycle. Downtime for tool changing on every shift is out; the Tru-Grit Rotary Diamond Dressing Wheel's finishing and dressing life goes far beyond anything known before. Savings in downtime, the increased number of pieces produced, the lower cost per piece over the life of the Tru-Grit Rotary Wheel are things to make cost engineers take a second look. But, perhaps the most dramatic difference of all is in the meticulous accuracy, fine finish and routine uniformity of the processed pieces. This is what quality control engineers have dreamed about and it makes quality control reports something of a formality. If you'd like facts and figures on actual applications of the Tru-Grit Rotary Diamond Dressing Wheel, write us.

WHEEL TRUEING TOOL COMPANY

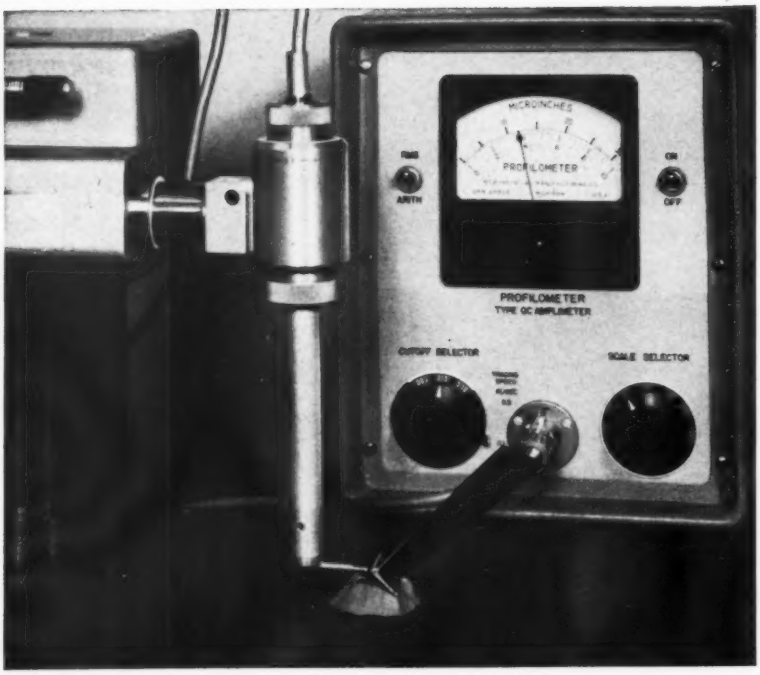
1910 **SEMI-CENTENNIAL** *1960*

Main plant and office: 147-3200 W. DAVISON, DETROIT 38, MICHIGAN
Southwestern plant: DALLAS, TEXAS • Western plant: LOS ANGELES, CALIFORNIA
Eastern affiliate: WHEEL TRUEING TOOL COMPANY OF NEW JERSEY, BLOOMFIELD, N.J.
Canadian plant: WHEEL TRUEING TOOL COMPANY OF CANADA, LTD., WINDSOR, ONT.

Oldest and largest diamond and diamond tool specialists in the Western Hemisphere

INDUSTRIAL DIAMONDS • DIAMOND TOOLS • DIAMOND-MISER TOOL TURNING DEVICES • MINING AND OIL FIELD DIAMOND DRILLS • MASONRY DIAMOND DRILLS AND SAWS • PORTABLE DRILLING MACHINES AND SAWS

CIRCLE INFORM-A-GRAM KEY NO. 17



PERTINENT QUESTION:

WHY do you need the Profilometer®?

FACTUAL ANSWER:

To check practically *all* surfaces against microinch roughness specs —and to help cut production costs in 7 different ways.

FREE BULLETIN LT14 gives details on the Profilometer and its practical applications. May we send you a copy?

MICROMETRICAL MMC® MANUFACTURING COMPANY
3621 S. STATE RD. ANN ARBOR 8, MICHIGAN

MANUFACTURER OF THE PROFILOMETER® • PROFICORDER® • MICROCORDER®
WAVOMETER® • ANDEROMETER® • VAROMETER®
CIRCLE INFORM-A-GRAM KEY NO. 18

. . . Month's Talk from page 16

1—Project Control By Computer

To set the stage, Du Pont designers are active on 500 studies and projects. With 1300 technical personnel working on such a large and diversified activity, much of it concurrently, you can appreciate the magnitude of planning and scheduling on drawings, procurement, specifications and the effective application of design manpower. Let us take a closer look at one of these activities.

A computer produces a procurement schedule; it shows a scheduled date versus an actual date for each phase as a procurement item progresses from "request for Quotes," to purchase, to fabrication release, and shipping. The Univac screens the multitudes of procurement schedules, then each project produces separate "Activity" and "Exception" reports. These tell us:

Procurement status by work type.
Delinquent items.
Items to be procured — sixty days.
Status of critical items.
Items, grouped by vendor.
Statistics for status charts.
"Activity" or "Exception" reports.

This is typical of the information produced for control of design activity. It results in timely application of our people to project work and puts the emphasis where it belongs.

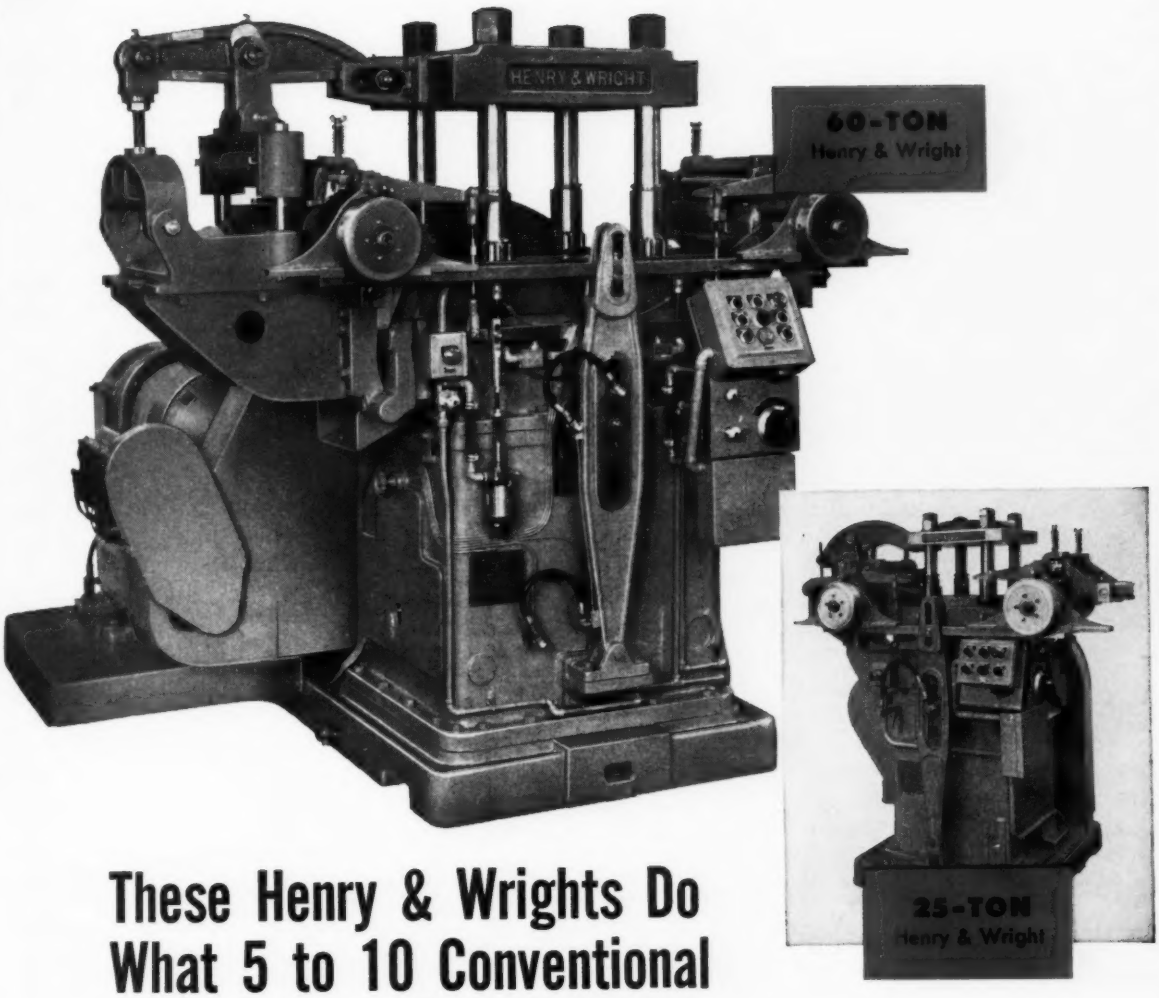
Within the next several years we will require memory devices with capacities in the range of 500 million to one billion digits. This will give us design information on instant demand and will further increase the utilization of our people.

2—"Arrow Diagramming" on Computers

A new approach to improved planning is the "Arrow Diagram" technique which was developed jointly by Remington Rand and the Du Pont Co.

Inherently, engineering projects contain a technological sequence in that parts cannot be started until others are partially or wholly complete. Conventional charting and graphs do not permit adequate analysis of thousands of details.

. . . Continued on page 20



These Henry & Wrights Do What 5 to 10 Conventional Presses Do- *More Quickly*

Over 3000 Henry & Wright Dieing Machines in service today, attest to the popularity of one of our earliest forms of automation. They were born to the mass production industry almost before it started. Every model employs the same basic design principles. A low center of gravity with all driving elements below the die bed assures stability for high speed operation. Precision alignment is provided by the long guiding surfaces; a pulling stroke rather than a pushing force gives better control; angular thrust of crankshaft is absorbed by lower crosshead instead of by slide or punch. These and many other features assure maximum die life, at higher speeds, with more profit for you.

These high production units can replace the work of several conventional presses cutting labor costs proportionately. Modern progressive dies can produce virtually any shape, with any material, simpler and faster. Let H-P-M engineers adapt Henry & Wrights to your next mass production problem. Take advantage of less operating cost, reduced amount of floor space required, greater production output.

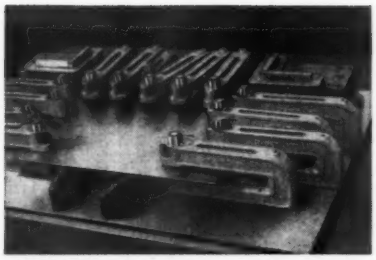
THE HYDRAULIC PRESS MANUFACTURING COMPANY

A Division of Koehring Company • Mount Gilead, Ohio, U.S.A.

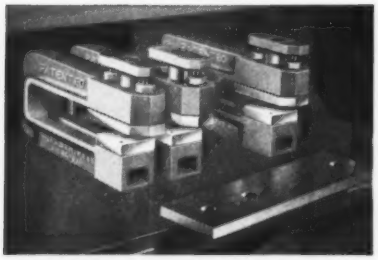
HPM H40

CIRCLE INFORM-A-GRAM KEY NO. 19

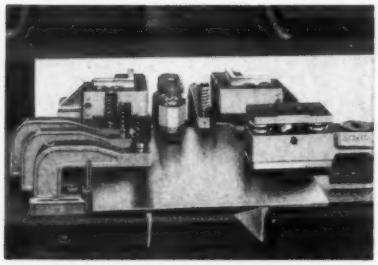
Cut costs with STRIPPIT Self-Contained Tooling



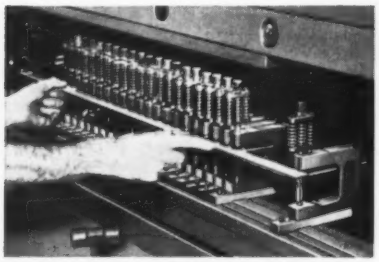
STRIPPIT eliminates expensive custom dies. Type "BL" Units in press setup save time and cost needed to design and build single-purpose dies. "BL" Units punch holes to 3.500" diameter in ⅛" material.



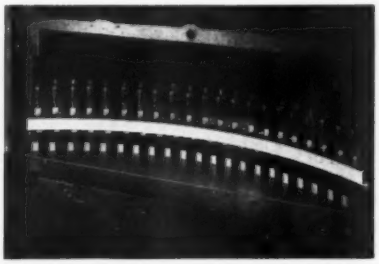
STRIPPIT shortens lead time . . . setup of Type "HS" Hydr.-Strip Units shows ¾" thick punched piece in foreground. STRIPPIT tooling like this can be set up *immediately* after the pattern is O.K.'d.



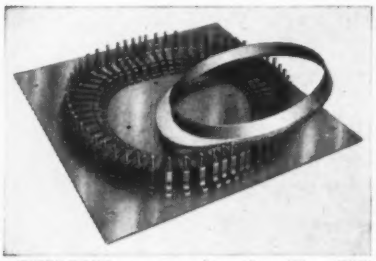
STRIPPIT assures minimum investment. "CJ" Units punch numerous hole sizes to 3.500" diameter. Simply replace punches and dies! Re-using units cuts investment in idle dies, minimizes storage problem.



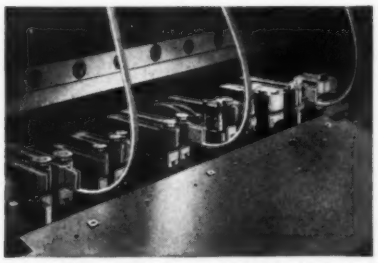
STRIPPIT lowers labor costs. Typical set-up of Type "C" Units can be set up by most bench men. No high-salaried tool and die makers needed. "C" Units punch holes to .3125" diameter in ⅛" material.



STRIPPIT sets up faster. Type "E" Units are permanently aligned to punch holes in channels and shapes. Pilot pin and punch are concentric for fast, accurate positioning on precision-drilled template.



STRIPPIT cuts press downtime. Type "H" Unit setup ready to move into press after previous run is finished. Nothing attaches to the press ram. Type "H" Units punch holes to .500" diameter in ⅛" material.



STRIPPIT versatility is unlimited. Type "BL" Pierce Nut Units punch and stake Fabristeel Multipierce Nuts, can emboss simultaneously. STRIPPIT units can be set up in any hole pattern and used repeatedly.

Write for the new STRIPPIT General Catalog

WALES **STRIPPIT** INC.

212 Buell Road • Akron, New York

In Canada: Strippit Tool & Machine Company, Brampton, Ontario.

CIRCLE INFORM-A-GRAM KEY NO. 20

. . . **Month's Talk from page 18**

In application, it starts by listing every job that has a bearing on the project. Then relationships are established — such as what must precede each job, what follows it, and what can be run concurrently. Next we inject the elements of time and cost.

Many details require a computer program developed to produce a series of optimum schedules and related costs. On a test of a recent project, 1700 job arrows were used to diagram the sequence of design activity. The computer produced 56 different schedules varying in overall time from 600 to 500 workdays.

One major disadvantage of the system is the considerable amount of input-detail required; we are investigating ways and means to alleviate this.

We have made major use of computers in our engineering research work for ten years and in design application about four years. From this experience we believe it worthwhile to prepare computer programs with a fundamental approach rather than empirical formulas. We are thus able to design less expensively with greater assurance.

3—Mechanizing Design Calculations

A number of factors stand out as being important to the successful use of machine computations for assisting design engineers. They are Management Action, Technical Adequacy, Personnel Training, and Timely Service.

Management Action: The question arose recently in a design problem whether the short-cut methods normally used were leading to over-design and unnecessary investment. Management's attitude is therefore a critical factor. If their primary concern had been with the cost of producing the designs, they would have been satisfied with short-cut methods. In this case, they wanted better designs leading to higher returns on investment.

Technical Adequacy: After analyzing our needs, we achieve a running computer program that is mathematically rigorous, technically comprehensive, and sufficiently general to handle most de-

. . . **Continued on page 24**

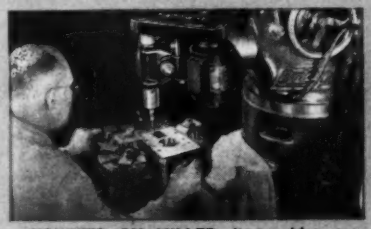
for PRECISION GRINDING

EXTERNAL and INTERNAL

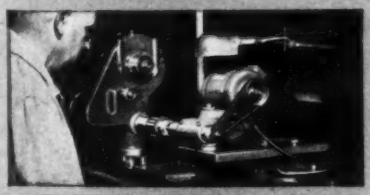
at lower cost

DUMORE®

TOOL POST GRINDERS



MOUNTED ON MILLER, it provides a high-speed precision grinding head for use with small mounted wheels, points or carbide burrs.



MOUNTED ON GRINDER, it provides a simple, efficient method for I.D. grinding.

MOUNTED ON PLANER, it provides a low cost surface grinder. Size of work is only limited by planer size.

Quick, easy mounting on lathes, planers, shapers, millers

With only the small tool investment in a Dumore Precision Grinder you *can* get that production, tool room or maintenance grinding operation done—*right on the basic machine tools you already own!*

Quick, easy mounting gets it on and off your machine tools fast. It converts lathes to cylindrical grinders . . . shapers, planers, millers to surface grinders . . . standard grinders to high-speed internal grinders.

Dumore Grinders have precision-built quills designed to give close tolerance performance at speeds from 4600 to 42,500 RPM. Nine models, from 1/14 to 3 hp, swing ⅛" to 12" diameter wheels. Interchangeable pulley settings provide correct surface speeds for efficient grinding in all wheel sizes. Priced from $93.00 up, FOB Racine. Write for details.

YOU CAN DO MORE WITH **DUMORE** PORTABLE PRECISION METALWORKING TOOLS

THE DUMORE COMPANY • 1304 17th St., Racine, Wisconsin

VERSA MIL • DRILL-N-TAP UNITS • DRILLING UNITS • DRILL HEADS
MICRO-DRILLS • DRILL GRINDERS • PRECISION GRINDERS
HAND GRINDERS • FLEX-SHAFT TOOLS • QUILLS AND ACCESSORIES

SEE YOUR LOCAL DUMORE INDUSTRIAL SUPPLY DISTRIBUTOR FOR ALL THE FACTS

CIRCLE INFORM-A-GRAM KEY NO. 21

The way Pipe Machinery's Correlchek Inspects NPT, ANPT, NPTF and NGT Threads

Here's an amazingly fast, accurate method for checking the pitch diameter, crest truncation and root truncation of precision pipe threads (internal and external).

You simply set the instrument with master gages using your present gage members — then presto — check your fitting to the proper tolerances indicated by color zones on the dial. There's nothing to remember — nothing to figure out. The Correlchek does all your thinking for you . . . completely eliminates any chance for human error!

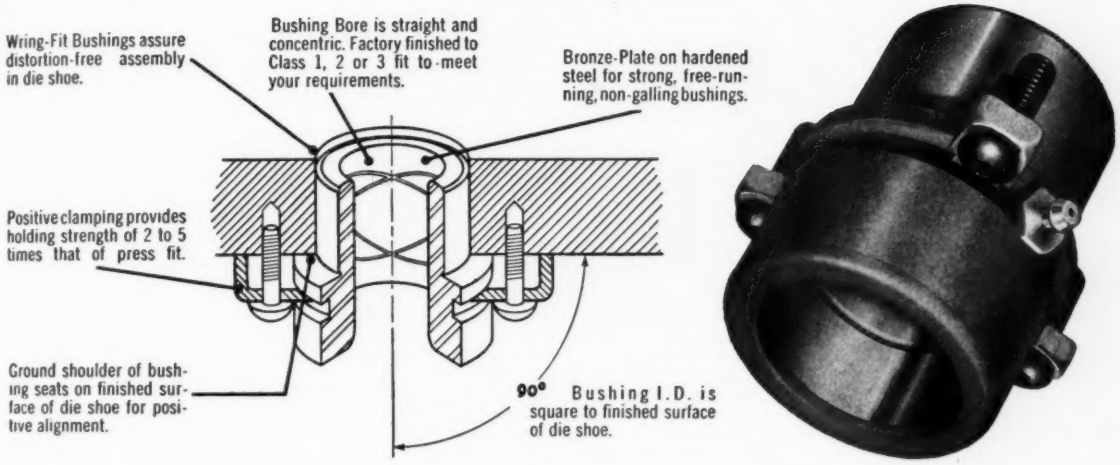
For more detailed information on this wonder working Pipe Machinery gage, write us on your company letterhead today.

THE PIPE MACHINERY COMPANY 29100 Lakeland Boulevard • Wickliffe, Ohio • Greater Cleveland

CIRCLE INFORM-A-GRAM KEY NO. 22

Lower Cost . . . Cut Maintenance . . . Lengthen Die Life

Lamina® BRONZE-PLATED GUIDE PIN BUSHINGS


Wring-Fit Bushings assure distortion-free assembly in die shoe.
Bushing Bore is straight and concentric. Factory finished to Class 1, 2 or 3 fit to meet your requirements.
Bronze-Plate on hardened steel for strong, free-running, non-galling bushings.
Positive clamping provides holding strength of 2 to 5 times that of press fit.
Ground shoulder of bushing seats on finished surface of die shoe for positive alignment.
90° Bushing I.D. is square to finished surface of die shoe.

LAMINA bronze-plated, wring-fit guide pin bushings are honed on the I.D. for accurate geometry, precise dimensions and to provide the best surface finish for lubrication. Bushings are wring-fit in die shoe to assure distortion-free, full-bearing surface that results in better die alignment, less maintenance and longer die life. In addition the Lamina method of clamping bushings to die shoes provides holding strength of two to five times that of press-fit bushings. For more accurate press operation, higher production and lower maintenance costs —standardize on Lamina, the originators of Bronze-Plated Guide Pin Bushings.

Lamina also manufactures: Steel Bushings and Guide Pins, Bronze-Plated Wear Plates, and Bronze-plated Parts. Complete facilities for the manufacture of steel or carbide precision dies (lamination, progressive, transfer, etc.).

Lamina Bushings and Guide Pins are made in types and sizes to meet every requirement. More than 800 items are described and illustrated in our catalog—write for your free copy.

Lamina®
DIES AND TOOLS, INC.
P. O. BOX 31, ROYAL OAK, MICHIGAN

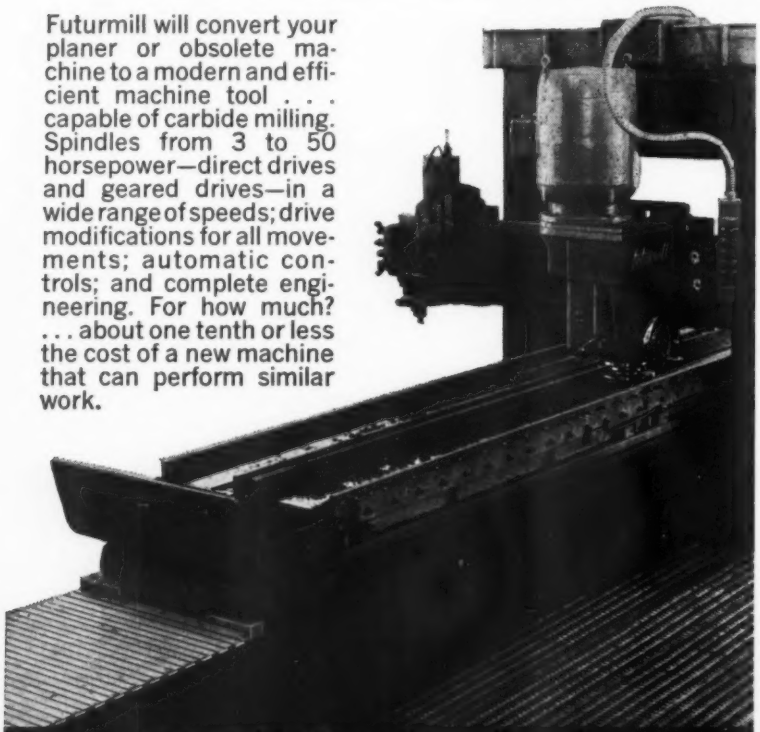
CIRCLE INFORM-A-GRAM KEY NO. 23

MACHINES THAT PRODUCE PROFIT . . .

Seventy Futurmill planer conversions remove more metal per hour than **Seven Hundred** unconverted planers of the same size and make

One company reports that a job previously estimated at thirty-three hours planing time per piece was reduced to four hours actual machine time per piece with their Futurmill conversion. The savings derived from the one job of 120 pieces more than paid the entire cost of converting the planer. Others report equally substantial savings in time; greater production capacity for one machine; and the discovery of many new applications for converted machines.

Futurmill will convert your planer or obsolete machine to a modern and efficient machine tool . . . capable of carbide milling. Spindles from 3 to 50 horsepower—direct drives and geared drives—in a wide range of speeds; drive modifications for all movements; automatic controls; and complete engineering. For how much? . . . about one tenth or less the cost of a new machine that can perform similar work.



For complete information—call or write:

Futurmill inc.

6360 HIGHLAND ROAD • PONTIAC, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 24

. . . Month's Talk from page 20

signs of each type. This is done by merely filling in data sheets for the computer.

Personnel Training: With the computer program we had to teach engineers how to use it. In the first place, it gave more detailed information on the expected performance of designs than they ever had before. Secondly, it demanded more precise knowledge of the details than the short-cut method. Finally they had to get used to the idea they could evaluate many alternative designs on the computer in less time than they could work through a single design by the so-called short-cut manual method.

Timely Service: One of the truly important features of our general-purpose computer programs, is the speed with which we get results. We take computer data sheets to the computer room and obtain printed answers within 24 hours. Or, we get a print out calling attention to mistakes made in filling out the data sheets.

4—Computer Information Application

In this industry, process evaluation studies are a big part of design. However, they are often time-consuming, after the idea for the alternative has been generated.

Among the methods available in attacking engineering problems, the most striking is the use of analogs to predict performance.

Analog simulation is exactly like having a miniature plant at your fingertips. It may be manipulated to operate almost any way you choose. While its behavior will match the plant's behavior the analog model operates without the limitations of a plant as to time, cost, safety, and disturbance of production.

With a simulated plant on a computer, different control settings can be tried 50 times an hour instead of once a shift. A dozen process changes can be simulated and evaluated in preference to the installing of a piece of equipment that may have to be changed. Emergency procedures can be tried also under conditions that may cause real production loss.

. . . Continued on page 26

ROTOR MIDGET GRINDER...

DEBURRS TWICE AS FAST ...pays for itself in 4 weeks

Job. Deburring fillet weld of spud inside of hydraulic cylinders. Formerly done with electric tools and hand files.

With Rotor M 1118 Grinder . . . equipped with mounted point or rotary file . . . does job in half former time. Savings paid for this 20,000 rpm Rotor air tool in less than 4 weeks.

Ask for demonstration of this midget grinder, and other cost-cutting Rotor air tools. Complete line described in Bulletin 53C, free on request.

Courtesy of Universal Hydraulic Co., Willoughby, Ohio

ROTOR AIR TOOLS: Assembly Tools • Drills Small Wheel Grinders • Straight Grinders Vertical Grinders • Scalers • Chippers Rammers • Special Tools • Air Motors.
ROTOR HIGH-CYCLE ELECTRIC TOOLS: Grinders • Polishers • Sanders.

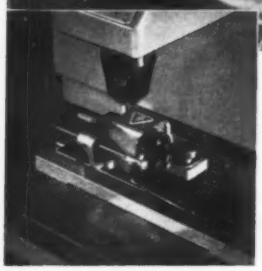
Here's the RIGHT TOOL for YOUR job!

ROTOR TOOLS

The Rotor Tool Company · Cleveland, Ohio

SUBSIDIARY OF THE COOPER BESSEMER CORPORATION

CIRCLE INFORM-A-GRAM KEY NO. 25



Measure SPECIALS Easily with This New Universal Staging Fixture

Cut set-up problems in measuring small parts, cylindrical pieces, odd shapes. There's a new Universal Staging Fixture to position just about *any* part up to 3 inches in length. Mount the part and see the sharp image on the distortion-free 10-inch screen. Get micrometer readings to .001". So easy unskilled help can learn it in less than half a day. Other big savings, too . . . extremely low purchase price, *plus* almost unlimited versatility. With your choice of understage and surface illumination, and the new Universal Staging Fixtures, you can just about write off special jigs and fixtures as a cost factor.

Find out more about how B&L can simplify your precision inspection. There's a complete line of instruments to help you. Mail the coupon now.

BAUSCH & LOMB INCORPORATED
77311 Bausch St., Rochester 2, N.Y.

Please send literature on:

- ☐ Bench Comparator, D-297
- ☐ Universal Staging Fixture, D-2007
- ☐ Toolmakers' Microscope
- ☐ StereoZoom Microscopes, D-15
- ☐ Scratch Depth Gage, D-2004
- ☐ Optical Aids, D-1059

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CITY ..... ZONE ..... STATE .....

BAUSCH & LOMB

SINCE 1853

CIRCLE INFORM-A-GRAM KEY NO. 26

. . . Month's Talk from page 24

5—Rapid Data Through Documentation

A documentation program is underway to maximize the re-use of one of our most valuable resources — the technical information generated by Engineering Department personnel.

Our key technical and economic information-aggregate of about a billion dollars investment is made available to help solve today's problems. For both past and current projects, the various unit operations, in an engineering sense, are segregated into information packages. They are indexed under dozens of terms which are then recorded in suitable equipment constituting a "memory."

Our engineers and designers tap this "memory" with inquiries. To answer inquiries mechanized searches are made by "memory" equipment, and design information relative to each question is identified and its sources are furnished to the inquirer. He reviews this data for broad answers and for the location of drawings, specifications, calculations or other detailed information pertinent to solving the problems at hand.

This saves time from fruitlessly searching; it avoids duplication of effort; it indicates areas where development is needed to answer frequent questions; it indicates where changes are desirable to overcome equipment operating difficulties and it supplies the technical man the best of past knowledge to use as a springboard to creation.

6—Models and Photography

The use of models is a major aid in producing economical design. Their integration into project work has increased the ability of designers to make major engineering contributions in less time.

Our model shops have up-to-date facilities and are spotted throughout the design working areas.

The study model is conceptual. It materially assists in developing the best arrangement with minimum design effort. It expedites agreements between design functions and our clients. Materials used in its construction are simple

. . . Continued on page 28

ANOTHER EXCLUSIVE from DoALL

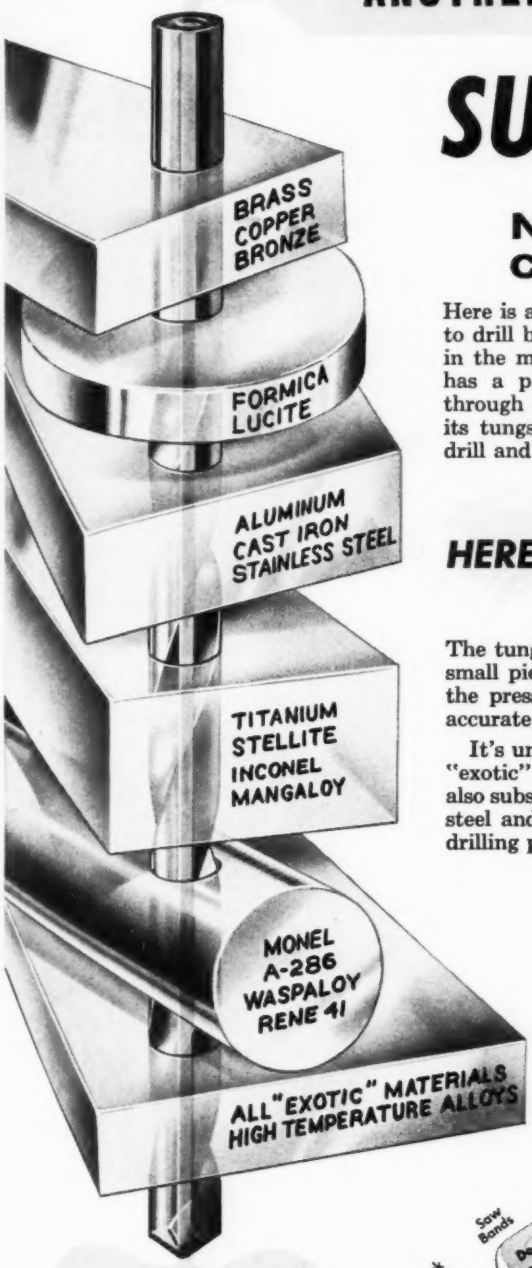
SUPER DRILLING

with

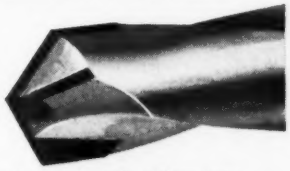
New COLD-POINT* Drill

Carbide Tipped • Patented

Here is a revolutionary new drilling concept that will enable you to drill blind, deep and through holes faster and more accurately in the most difficult of materials. The new *COLD-POINT Drill* has a patented internal cooling facility that delivers coolant through the drill, ejecting it under high pressure at the point of its tungsten carbide tip. Heat is carried away so fast that the drill and workpiece seldom reach temperatures above 100 deg. F.



HERE'S THE POINT . . .



The tungsten carbide tip has a negative rake to break chips into small pieces. These are quickly flushed up through the flutes by the pressurized coolant. Results: faster drilling; no withdrawal; accurate, superfine finished holes that often eliminate reaming.

It's unequaled in hard, tough, abrasive materials, including the "exotic" high-temperature alloys. The *COLD-POINT Drill* will also substantially increase production on aluminum, brass, stainless steel and many other materials which do not present as great a drilling problem as high-temperature alloys.

AVAILABLE IN 3 LENGTHS

COLD-POINT Drills are available through your nearby DoALL Sales-Service Store. Over 200 standard sizes, ⅛"-¾", and letter sizes A-Z, in Jobbers, Stub and Taper Lengths. Special lengths, diameters and internal threaded shanks can be furnished promptly. Also available: h.s.s. and DoALLoy† (cast alloy) tips. Prices on application.

Start cutting your drilling costs with DoALL *COLD-POINT Drills*. We invite you to try these sensational drills on your own work. Call your local DoALL Store today.

With COLD-POINT Drills

you get increased productivity at lower cost on your . . .

- Screw Machines
- Chucking Machines
- Drilling Machines
- Turret Lathes

COLD-POINT Drills can be used on any machine with hollow spindle. Any other machine can be easily adapted with a coolant-fed chuck.

*Reg. T.M.—Mossberg U.S. Patent No. 2,871,983 CT-64

†Reg. T.M.—The DoALL Company

THE DoALL COMPANY • DES PLAINES, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 27

NEW HAMILTON VARIMATIC® DRILLING MACHINE

2960b

CAPACITY TO 5/16"

Drills to the center of a 10" circle. Head swings radially on column and locks at any position. Vertical adjustment of head on column, 6". Spindle speeds from 840 to 9300 R.P.M. infinitely variable in two ranges. 2½" feed of spindle.

NEW bearings, new castings, new ratios make *this* Varimatic the most accurate, the most rigid we have ever built.

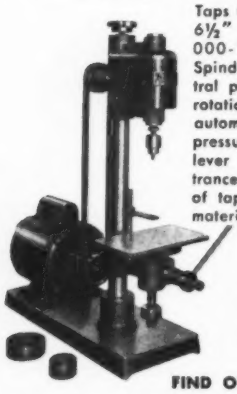
CLEARANCES

Center of chuck to column	5"
Round table to chuck	10"
Rectangular table to chuck	9½"
Base to chuck	14"

This new Varimatic brings a new dimension to **the production drilling of small precision holes.** See it at your dealer's show room.

COMPANION TAPPER

also Super Sensitive and Precise



Taps to the center of a 6½" circle. Capacity, 000-120 to 10-24. Spindle returns to neutral position and stops rotation instantly and automatically when pressure on the feed lever is released. Entrance and withdrawal of tap is *gentle*. Thin materials are tapped without stripping. Brittle materials without chipping. Blind holes without tap breakage.

FIND OUT ABOUT IT

Our Bulletin No. T/2960 illustrates and describes the Hamilton Super Sensitive Tapping Machine in full. Shows features by means of a sectional engineering drawing. It's free, too. Write for it today.

If you would like the complete Varimatic story . . . with pictures, and a sectional engineering drawing . . . write for our FREE Bulletin No. V/2960.

THE HAMILTON TOOL COMPANY

832 SOUTH NINTH STREET
HAMILTON, OHIO
CIRCLE INFORM-A-GRAM KEY NO. 29

. . . **Month's Talk from page 26**

and rough. For instance, wood and wire are used to mock-up different arrangements before arriving at a satisfactory one. This study model work is usually done in the drafting room, by the engineer and designer.

The field transmittal model is the result of a team effort of designers and modelmakers and is built to sufficient scale to give design information for actual construction. As an added dividend, they are used to train operators, determine accessibility of components, safety, and maintenance needs.

We use photographic equipment and sensitized drafting film to make useful engineering drawings of most anything that can be photographed.

The future will see an expanding application of models and photography to engineering. They initiate more creative designs, reduce routine drafting, and enhance the engineer's responsibility toward designing facilities for low investment, operating and maintenance costs.

7—Enhancing the Research Design Relationship

In business, things change rapidly and we must keep running to stay ahead. Out of the laboratories have come new materials and techniques from which have evolved advantages never before enjoyed by previous generations. Research on the part of both us and our competitors is characterized by a constant quest for new ways to exploit matter and energy.

To compress the "research design phase," for optimum project benefit, requires the ultimate in cooperation between these two groups. To achieve this cooperation, it is essential that there be early participation of design at the time the research program for a project is being organized. Normally research personnel are long on scientific training, knowledge and ability but short on experience, economics and commercial "scale." Design can assist research programs by taking a constructive look at research proposals, and pointing out areas that need further exploration for practical considerations.

"Product yield" and "equipment utility" are very important factors in determining when a product is sufficiently developed for sale. Sound design judgment can materially assist the research team to interpret and project the results.

We assign first-line design talent to handle key posts in the "joint-effort" approach on project work. The pattern, not new to industry, permits taking maximum advantage of design know-how in the early stages of project development. Maximum advantage of the team from research, manufacturing, sales and others, is quite an advantage.

Research and design are both objectively creative. One is more fundamental — the other more practical in approach, and their apartness does not belong in the future. The most successful ventures will find "research-design," as a closely knit team effort.

8—Enhancing The Design-Construction Relationship

Project complexities and new innovations in recent years, and in the years ahead, demand increasingly stronger ties between design and construction if we are to achieve a high plane accuracy.

To further enhance this relationship, we have established three active design-construction committees; namely, materials handling instruments, and electrical.

Typical of all three is the materials handling committee. Its organization consists of representatives from construction, expediting, vendor inspection, design, engineering consultants, and purchasing. They meet monthly and give wide distribution of their minutes. They also issue a *Materials Handling Manual.* Objectively these committees promote effective exchanges of design and construction information for the combined impact in solving problems. They review available materials and methods, and develop new ones.

9—Productionizing Construction

"Productionizing" of construction work is a potent source for reducing cost. Design plays a very important part in maximizing these savings.

. . . **Continued on page 32**

NEW HAMILTON VARIMATIC® SUPER SENSITIVE DRILLING MACHINE

The NEW Hamilton Varimatic, Super Sensitive, Variable Speed, Small Hole, Precision Drilling Machine is, by far, the smoothest Varimatic we have ever built. It has fewer parts, is subject to less wear, and requires less maintenance than ever before. Tolerances have been tightened. Working clearances have been increased. It offers flexibility and sensitivity, accuracy and stamina far beyond the requirements of the average user.

Some specifications are given in the one column ad on the facing page.

It's a 2960a HAMILTON TOOL

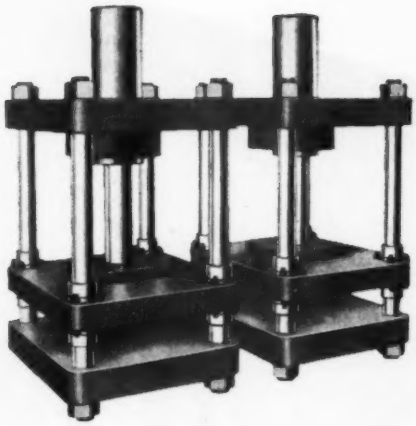
use it with confidence!

THE HAMILTON TOOL COMPANY

832 SOUTH NINTH STREET **HAMILTON, OHIO**

CIRCLE INFORM-A-GRAM KEY NO. 29

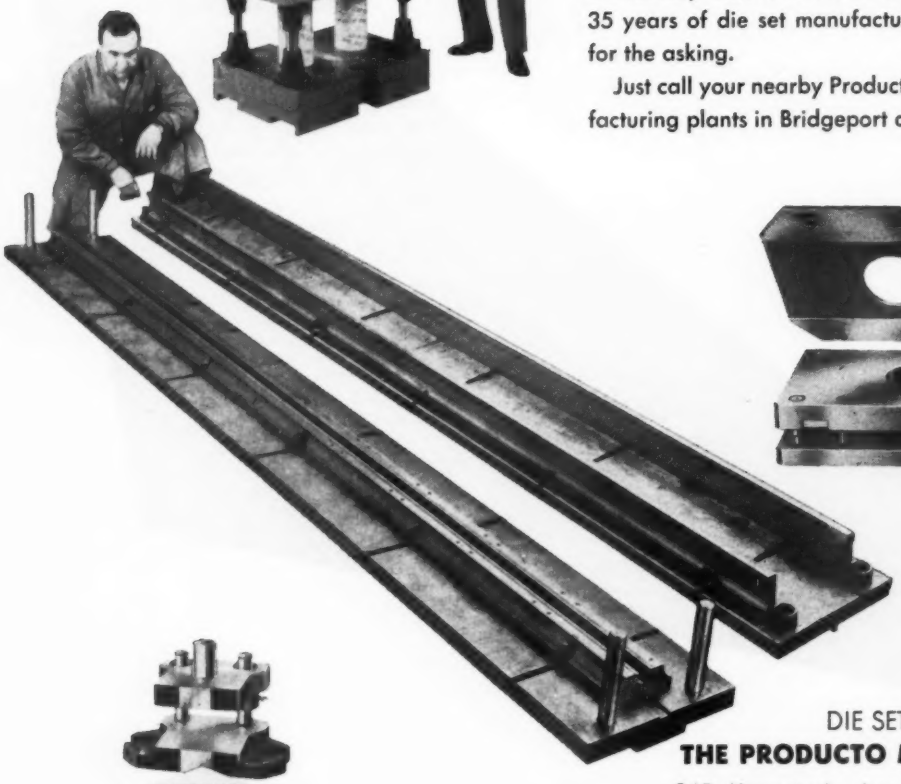
Do you have a special die set problem?

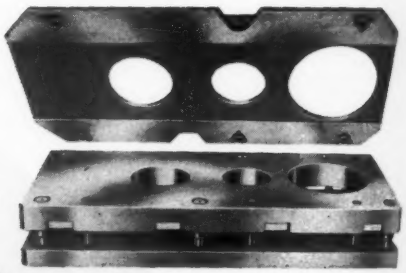


Producto can help you solve it. Special die sets can be large or small—weigh tons or a few pounds; they may be of steel plate, or castings; two-plate or multi-plate.

Often, they can be ordered directly from Producto's catalog. We regularly machine our "catalog specials" to meet your individual requirements. And, when you need a radically different, one-of-a-kind die set—call us. Our 35 years of die set manufacturing experience are yours for the asking.

Just call your nearby Producto distributor, or our manufacturing plants in Bridgeport or Detroit.





PRODUCTO

DIE SET DIVISION
THE PRODUCTO MACHINE COMPANY
945 Housatonic Ave., Bridgeport 1, Conn.

PRODUCTO

DIE SETS & ACCESSORIES • PUNCHES & DIES • TOOLROOM EQUIPMENT

CIRCLE INFORM-A-GRAM KEY NO. 30

DEPENDABLE . . . predictable response to heat treatment every time

Send for Bulletin 102— "Helpful Heat-Treating Hints."

The full uniformity within each bar of Desegatized FM die steel and the consistent uniformity from lot to lot simplifies the heat treatment of your die components. Predictable hardnesses are readily attainable . . . distortion and size change are minimized . . . danger of cracking is lessened!

In free machining FM die steels, full uniformity is achieved through Latrobe's unique Desegatized process of manufacture. This process guarantees an even distribution of carbide particles, free machining alloy sulphides and other alloying elements . . . factors leading to improved machinability, greater toughness and improved wear resistance in addition to the optimum heat-treating characteristics.

Latrobe's 12% chromium FM die steels are available through district steel service centers near you. Grades include: Olympic FM (Type D-2) for long-run applications; GSN FM (Type D-3) non-deforming die steel; Cobalt Chrome FM (Type D-5) for extra resistance to galling and pickup.

Call your Latrobe representative today!

Manufactured by skilled American labor

LATROBE
Metalmasters

LATROBE STEEL COMPANY
LATROBE, PENNSYLVANIA

BRANCH OFFICES and STEEL SERVICE CENTERS: BOSTON • BUFFALO • CHICAGO CLEVELAND • DAYTON • DETROIT • HARTFORD • LOS ANGELES • MIAMI • MILWAUKEE NEW YORK • PHILADELPHIA • PITTSBURGH • SAN LEANDRO • TOLEDO

CIRCLE INFORM-A-GRAM KEY NO. 31

HANNIFIN
has a faster,
more rugged
AIR MOTOR

Truly a convenience package, the Hannifin Air Motor combines a rugged, low-friction, double-acting air cylinder with a solenoid valve. Ample air passages permit rapid cycling. Built-in speed controls make it possible to slow either or both strokes. Mounting dimensions interchange with most existing applications. "Off shelf" delivery in "standard" strokes. Bulletin 215—free on request—describes this new product.

PARKER HANNIFIN CORPORATION
PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS
HANNIFIN COMPANY
A DIVISION
563 South Wolf Road
• Des Plaines, Illinois
3155-PH

CIRCLE INFORM-A-GRAM KEY NO. 32

. . . Month's Talk from page 28

Steps are taken in each project to insure modular repetition. It was agreed that a model would be used and that during its development, it would be studied in minute detail by design and construction engineers as well as by research. Each was given every opportunity to make his best contribution to the project. As design progressed, changes were made to the model wherever improvements were apparent. Engineers and superintendents were brought in from construction for consultation and advice. Concurrently construction engineers plan for the most economical sequence of installation.

Admittedly every job is not a laboratory nor does it offer the same potential. However, we have applied the same principles to much of our work in varying degrees. Importantly, they take full advantage of the combined "know-how" of design and construction engineers.

10—Engineering Standards

Application of over 3400 Engineering Standards has materially advanced the effective utilization of technical forces. For example, during the past three years, design forces annually used standards on an average of 440,000 times.

They are not product standards but are tailored to engineering needs. They include design details to reduce repetitive drafting time; specifications of materials, equipment, and jobs; design data, including formulas, tables and theory to aid in solutions of engineering problems; and proven ways of doing repetitive plant maintenance and construction work.

Our standards program is currently giving us a four-to-one return for every dollar spent on standards activities.

11—Policies and Programs for Effectiveness

Ever-continuous is the requirement to find new ways and means by which engineering talents are motivated to more effective application. Today, and certainly for the years ahead, we are a part of a civilization which has and will become progressively more complex with every break-through in advanced technology.

The eleven techniques just outlined are not the complete answer to a successful design operation. Realizing this, we encourage and promote the individual's professional growth and strive to provide incentives that will exercise his skills and talents. For example:

It is policy to fill vacancies.

Development is advanced by responsibility.

Performance is looked upon as an opportunity.

Drafting is contracted for during peaks.

Design participates in cost reduction.

We practice flexibility in organization.

Closing

"What's Ahead" for the design forces of tomorrow? Most assuredly they must, and will, be breaking away from the traditions of yesterday and of today. They will be solving the complexities of laboratory achievements as well as the complexities of their own ingenuity and creativeness for the design of profit-making plants. Success depends heavily on contributions that will optimize the gains and minimize the risks.

Gentlemen, today has not only been a privilege, but it has been a great pleasure. I can close in no better way than by leaving this thought, "Who dares to try to paint tomorrow's masterpiece with today's brushes."

Absolute Edge Geometry

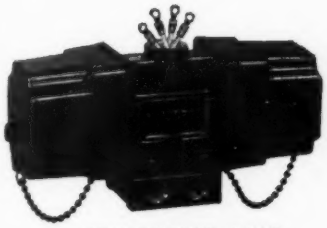
The De Vlieg Machine Co., Royal Oak, Mich., has recently been granted a patent on a newly developed tool grinder. This grinder assures absolute cutting edge geometry control on cemented carbide, high speed steel, and ceramic type cutting tools.

The new Micropoint grinder claims to be the first to be able to grind single point cutting tool profiles geometrically correct to gage accuracy. In one test, as many as 300 identical tools, ground without corrective adjustment, required a total setup time of 5 min.

Because of improved grinding we understand that tools last 15 to 50% longer.

SAVE TIME, AIR, MONEY

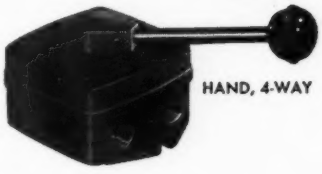
with PARKER-HANNIFIN One-Source Engineering



DUAL SOLENOID, 4-WAY

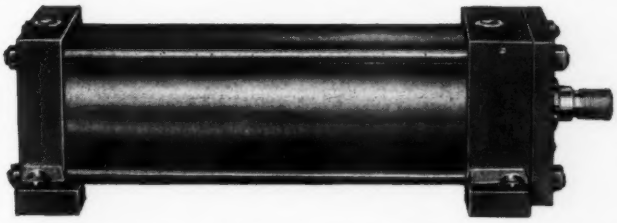
CAM, 3-WAY

PRESSURE, 3-WAY



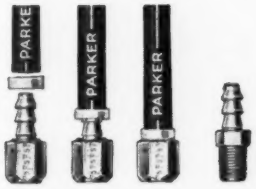
HAND, 4-WAY

Use flow factors as money-savers—your Parker-Hannifin man can show you how. They help you to avoid "oversizing" your valves. Hannifin's new Valve Finder gives "C_v" ratings for every valve in the line, makes it possible for you to take full advantage of the extra air-flow capacity in Hannifin air valves. Get your copy today.

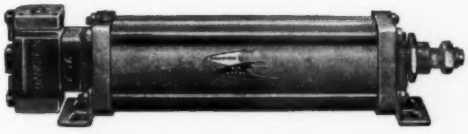


Low friction, long packing life are money-saving features of the Hannifin Series "A" pneumatic cylinder, available in a full range of mounting styles and from 1½" to 14" bore, strokes to 20 feet. Hannifin cylinder application data and charts make selecting the right Series "A" cylinder easy. Get yours from your Parker-Hannifin man.

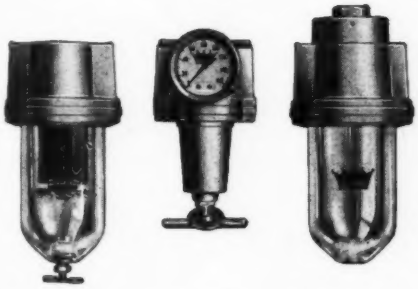
Pneumatic systems tube up fast with Parker "Intru-lok" tube fittings. Use them with copper, nylon or "Parker-POL" polyethylene tubing. Just insert the tube and tighten the nut for a leakproof "bite-type" joint.



Another time-saver is "Push-lok", the Parker hose-and-hose-fittings combination for pressures to 250 psi. No tools needed. Just push this hose on these hose fittings. They won't blow off, ever, not at twice 250 psi.



One air line conection installs the Hannifin Air Motor... an integral solenoid valve controlling a fast, rugged double-acting air cylinder. Built-in speed controls adjust piston speed in either or both directions.



You will save both air and money with Hannifin "Crown" air line filters, pressure regulators and lubricators. Let your Parker-Hannifin man show you how they pay for themselves by making it possible to get all the air flow you need at the exact pressure that will best do the job. "Crown" filters and lubricators will bring further savings through reduced equipment maintenance.

Your pneumatic system shapes up faster at the design stage when one man can discuss with you every component you'll need. But have you realized how much your Parker-Hannifin man can save you in money and air?

Just for instance... your valves don't have to be ¾" just because the cylinder size you select comes with ¾" ports. Your Parker-Hannifin man chooses valve types and sizes to suit the air flow you'll need. He'll show you, too, how pressure control saves money and air, how a smaller lubricator is often a more efficient lubricator, and other money saving ideas. Then he'll show you ways to "tube up" and "hose up" a leakproof pneumatic system quicker, neater and at lower cost.

Call your nearest Parker-Hannifin sales office, or write direct for complete information.

Parker FITTINGS AND HOSE DIVISION
17325 Euclid Avenue • Cleveland 12, Ohio
HANNIFIN COMPANY
A DIVISION
563 South Wolf Rd. • Des Plaines, Illinois
PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS

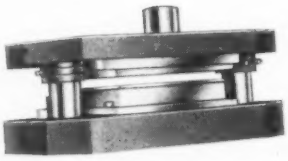
3139-PH

CIRCLE INFORM-A-GRAM KEY NO. 33

Needles are cut and twisted at the rate of 1,960 per minute.

150 MILLION STROKES

WITH ONE SET OF PINS AND BUSHINGS!



Danly precision, all-steel, center-post die set protects this valuable high-speed die for Regal Electronics Company, Chicago

Aluminum foil strip, six inches wide and .003″ thick, is blanked and formed into two 3-inch strips of curled and twisted "Sapphire" Christmas tree needles at *980 strokes per minute!* To maintain required .0005″ punch-and-die clearance and take ¾″ strokes at this "motion-picture speed", Regal Electronics Company, Chicago, required true precision in a die set.

After 150,000,000 strokes in seven months of almost continuous operation, their Danly die set was still operating with its original Microme guide posts and demountable bronze-plated bushings!

Danly production methods consistently maintain the highest standards of die set precision through individual control of every critical dimension. Thousands of tool and die shops agree that the finest die set obtainable is usually the lowest cost insurance on any die-making investment. Find out how Danly precision can save money for you.

Write for our new folder on
"The Importance of Die Set Precision."
Lists and discusses all critical dimensions . . .
shows how and why consistent Die Set precision
is vital in every die-making operation.
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Branches and Distributor Assembly Plants in all Toolmaking Centers

DANLY

DANLY®

DANLY MACHINE SPECIALTIES, INC. / 2100 SOUTH LARAMIE AVE., CHICAGO 50, ILL.

Mrs. Florence Smith, operator of the Federal Products Corporation, achieves ultra-precise results with the No. 3 Moore Jig Grinder.

Woman operator at Federal Products maintains 50 millionths accuracy with No. 3 Moore Jig Grinder

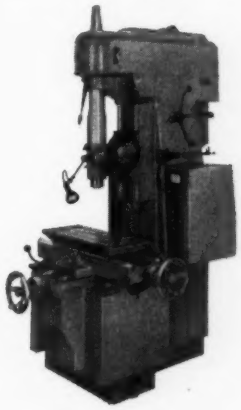
Moore Special Tool Company numbers among its long-time customers the Federal Products Corporation of Providence, Rhode Island—a leading manufacturer of dial indicating, air, electric or electronic gages—special equipment used for measuring, inspecting, sorting or automatic gaging.

The type of work produced by Federal Products calls for highly skilled personnel, not the least talented of which is a woman jig grinder operator, Mrs. Florence Smith.

Mrs. Smith has a *natural* mechanical ability. She is Federal-trained, starting in their plant during World War II. Most of her work is producing masters for precision gages with small holes and slots. Her work is extremely accurate—and she keeps complete records of work performance. She is able to maintain accuracy to within 50 millionths...using the No. 3 Moore Jig Grinder.

Moore machines have been dependable performers in Federal Products Corporation's precision grinding room for a number of years. The company also uses other Moore equipment, such as the Moore Precision Rotary Table and Moore accessories...all of which help Federal meet their customers strictest requirements.

Write today for literature describing all the advantages of the No. 3 Moore Jig Borers and Jig Grinders.



Partner in Precision: No. 3 Moore Jig Borer

This new Moore Jig Borer is unequalled for the speed and accuracy with which it bores, drills, reams and spots holes in dies, jigs and production parts. It breaks the "tenth barrier." It offers more precise positioning tolerances...improved drive ...wider speed range, 60 to 2250 RPM...larger table working surface, 11 x 24".

MOORE SPECIAL TOOL COMPANY, INC.
726 Union Avenue, Bridgeport 7, Conn.

HOLES, CONTOURS AND SURFACES. Tells how to produce tools and dies the modern way. 424 pages, 495 illustrations. $5 in U.S.A. $6 elsewhere.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

CIRCLE INFORM-A-GRAM KEY NO. 35

What did this failure cost?

LOOK TO INGERSOLL FOR THE ANSWER

Probably a lot more than should have been gambled! Misapply a cutter, or fail to match it to the machine, and costly failure can be predicted as a certainty.

Only when metal removal programs are carefully analyzed in advance can cutter misapplications be assuredly avoided. That's why many firms rely on Ingersoll for help in arriving at the economical answers to their cutter selection and application questions.

Costs reduction is planned before, not after the work is done. Why not let an Ingersoll representative make a preliminary survey of your upcoming metal removal jobs? It will cost you nothing . . . could lead to important savings. Ask a representative to call, or write for the booklet, "Ways to Reduce the Cost of Chips." Address Dept. 11-68.

THE **INGERSOLL**
MILLING MACHINE COMPANY **CUTTER DIVISION** ROCKFORD, ILLINOIS

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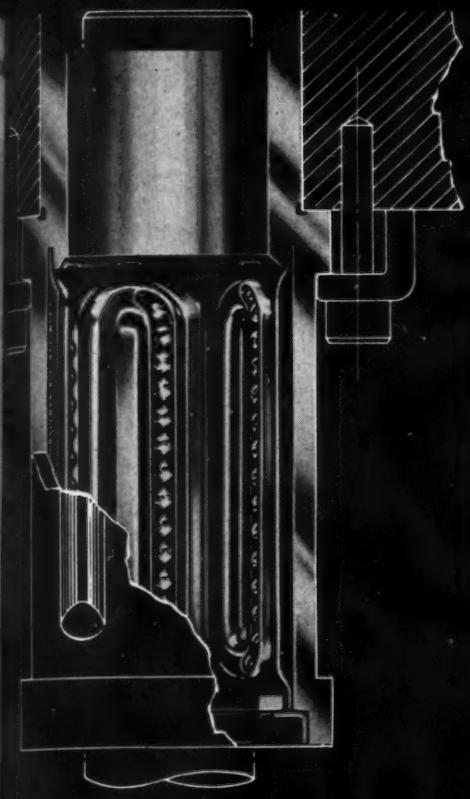
CIRCLE INFORM-A-GRAM KEY NO. 37



THOMSON INTERCHANGEABLE die-set BALL BUSHINGS®

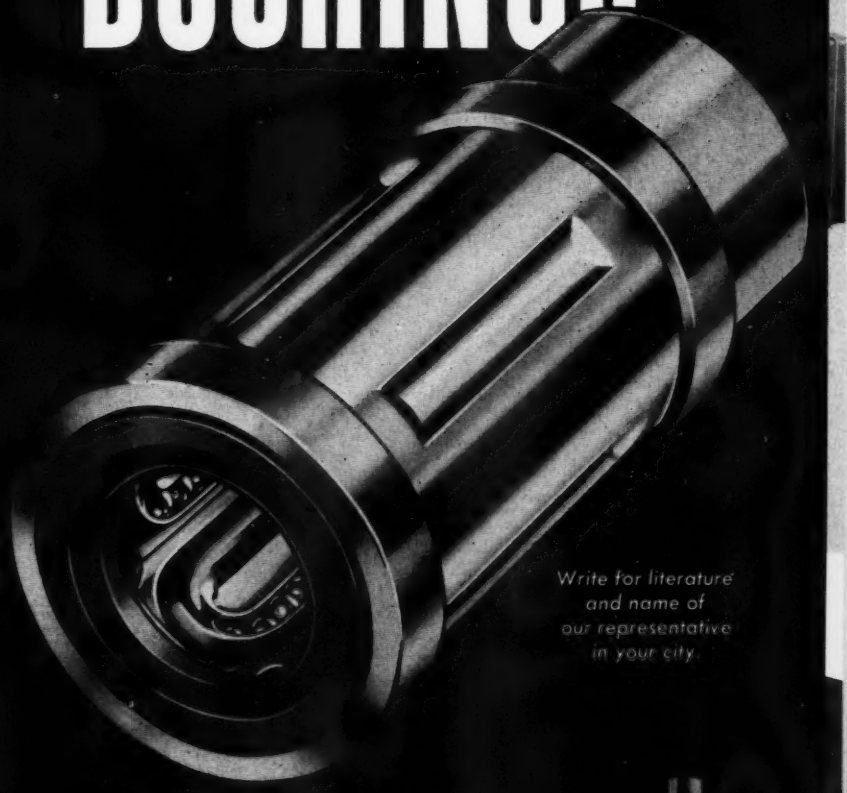
NEW!

iO ANTI-FRICTION

th a simple bushing replacement

nd (1) Improve performance of your *present* dies

and (2) Reduce tool room costs



Write for literature and name of our representative in your city.

in the PRESS ROOM

Ball Bushings allow closer fits and maintain gnment which increases die life and permits nger uninterrupted runs. Fewer sharpenings and stained parts accuracy also result. Periodic lubcation is eliminated and higher speeds are posle. Unlimited travel permits die to be used in ny press regardless of stroke. Costly smash-ups ue to seizure are eliminated.

in the TOOL ROOM

No cocking and binding — hence the punch holder "floats" on and off! No time consuming die jacking! Free-rolling *ball* bearings enable the toolmaker to actually "feel in" the fit of mating parts. This saves more time and makes better dies.

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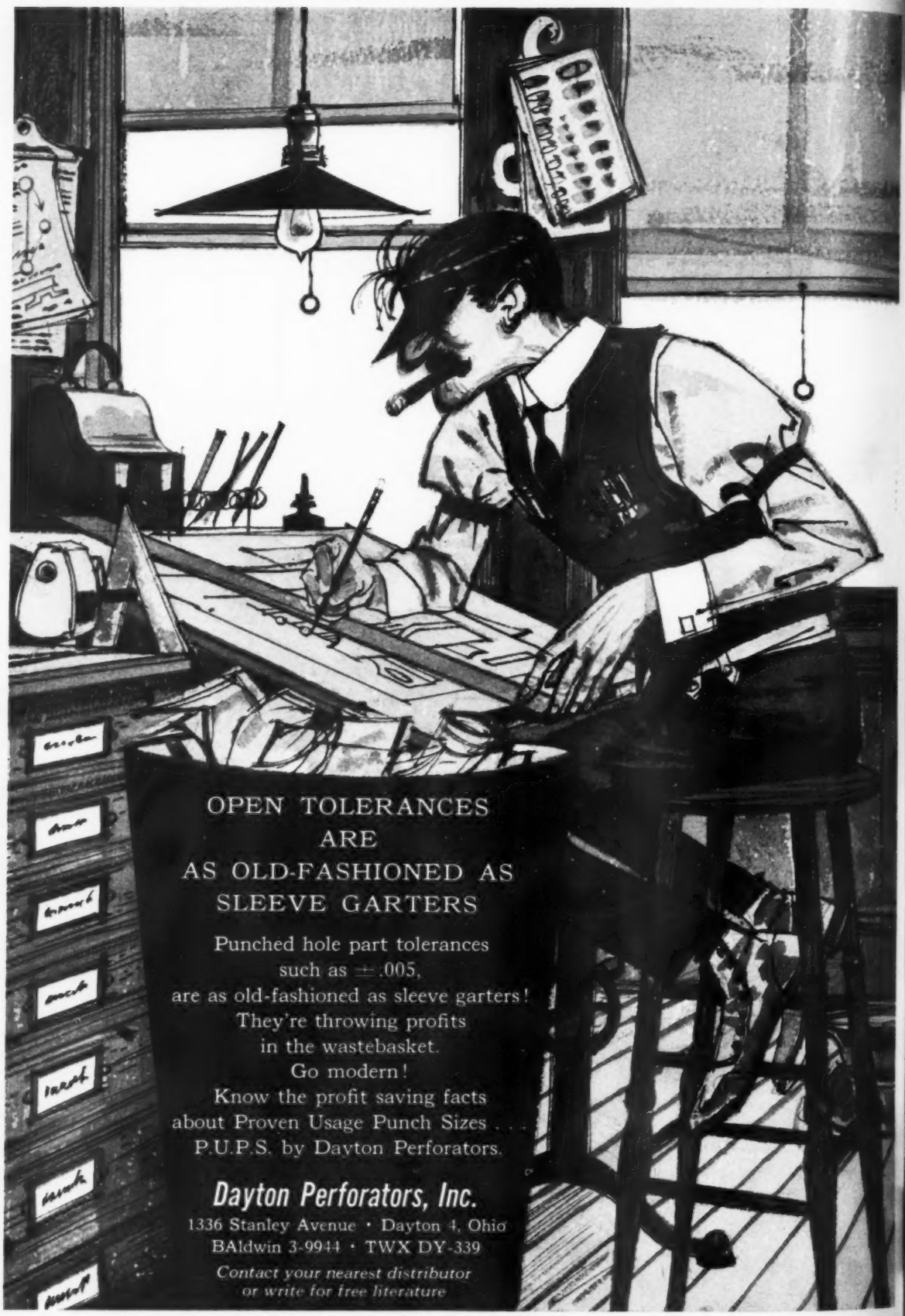
Dept. D-5, MANHASSET, NEW YORK

Makers of *60 Case* hardened & ground shafting and NYLINED Bearings... Sleeve Bearings of DuPont NYLON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ARE
AS OLD-FASHIONED AS
SLEEVE GARTERS
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such as ±.005,
are as old-fashioned as sleeve garters!
They're throwing profits
in the wastebasket.
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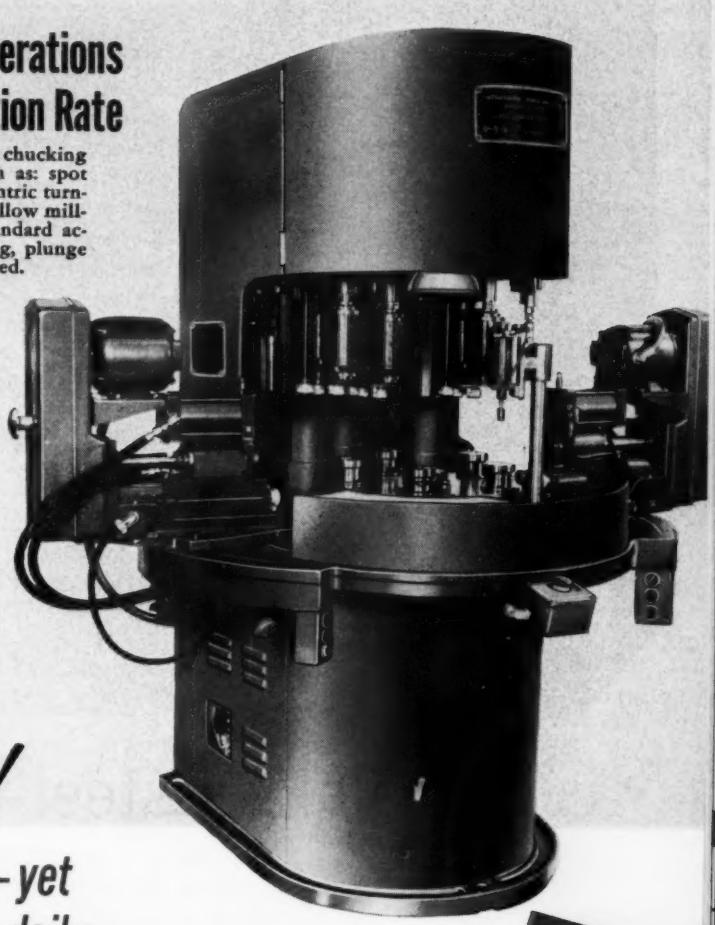
ANNOUNCING

Standard Tool's New Second Operation Machine

Performs Multiple Secondary Operations Simultaneously at a High Production Rate

Standard Tool's new five spindle multiple-automatic chucking machine simultaneously performs operations such as: spot facing, countersinking, chamfering, centering, eccentric turning, deburring, box tooling, counterboring, and hollow milling and saves both time and money. With the standard accessories, operations such as slotting, cross milling, plunge milling, tapping and threading can also be performed.



- ☆ *Economical for long or short run production*
- ☆ *Quick-easy-accurate set-ups*
- ☆ *Eliminates special fixtures*
- ☆ *Chucks round, square and hexagonal parts in standard spring collets*
- ☆ *Automatic chucking and part ejection*
- ☆ *Uses many automatic screw machine tools*

The machine is primarily designed for secondary operations on piece parts made on automatic screw machines, and is ideally suited for those operations that naturally slow the time cycle of automatics.

Remarkably Reduces Second Operation Machining Costs!

New to industry at large – yet field tested and proved in daily operation by a selected group of users:

Micro Switch Division of Minneapolis-Honeywell Regulator Co.
Bell & Howell Company
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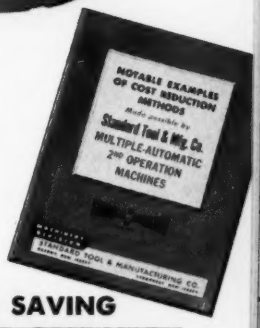

THIS FREE BOOK DETAILS 30 TYPICAL COST SAVING EXAMPLES USING STANDARD TOOL'S SECOND OPERATION MACHINE *Write for your copy today!*

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STANDARD TOOL AUTOMATION
MACHINERY DIVISION

Better Products at Lower Costs thru Better Methods!

STANDARD TOOL & MANUFACTURING CO.
706 SCHUYLER AVENUE LYNDHURST, NEW JERSEY

Erickson Precision Expanding Mandrels Solve Machining Problems

Photo: Courtesy Ex-Cell-O Corporation, Detroit, Mich.

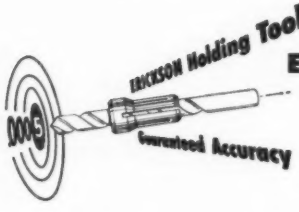
e. g. stainless steel aircraft sleeves

Tolerances of the highest order are required on aircraft sleeves. And when the material is stainless steel this can lead to production problems.

But Ex-Cell-O Corporation short-circuits their problems by using an Erickson 4½" C Drawbar Expanding Mandrel on an Ex-Cell-O precision boring machine. By using the Erickson mandrel they are able to machine completely the outside diameters, face a shoulder and put chamfers on both the OD and the ID of the exposed end. Production is up, rejects and scrap are down.

If you have a production part requiring exceptional tolerances . . . if instantaneous release feature can speed loading or unloading—Erickson Precision Expanding Mandrels can pay real production dividends.

A-2141A



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Plagued by tough holding problems? Then let us show you how Erickson Precision Expanding Mandrels speed production and slash costs of machining, grinding, assembling or inspection. Write for your free copy of Catalog K today.

CIRCLE INFORM-A-GRAM KEY NO. 40

The Editorial

MACHINE REPAIR & RECONSTRUCTION ...PATENTWISE

THE U. S. PATENT SYSTEM is an outstanding bulwark to our free enterprise economy. It is, in effect, a built-in incentive system that serves large and small business alike. From the R & D departments of our largest corporations to the basement tinkerer the final granting of a U. S. Patent may represent the culmination of years of toil or it may result from an inspiration that was but a few seconds in the making.

Of no small wonder is the intense and widespread interest in the subject. Over the years we have presented many articles on various phases of patent laws and procedures, and these articles have never failed to generate a lion's share of reader response and enthusiasm.

In the work-a-day world of patents all is not beer and skittles — there are many pitfalls for the unwary. The mere holding of a U. S. Patent is not a sure path to fame and fortune — witness the great number of patents, and claimed infringements there-on that are subject to litigation in our courts and which drag on for years and years.

Remember that when Uncle Sam grants you a patent he is simply conferring on you the right to exclude others from making, using or selling the invention covered by your patent. In no wise is Uncle Sam your partner in this enterprise. The burden of proof rests entirely on you. The right to "exclude others" is yours to exercise and it can be an expensive right, with you footing the bills. The rewards in such a circumstance, any damages you may recover, lie entirely in the strength of your case as presented by your attorneys and as interpreted by the courts.

Since 1836, the number of U. S. patents granted is crowding the 3,000,000 mark; patent No. 2,900,000 was issued August 18, 1959. This is indicative of the vast technology we have created and which has become an intimate part of everyday business.

For the purposes of determining patentability, the Patent Office has divided patents into some 300 classes and more than 52,000 subclasses. Considering that these categories now accommodate nearly 3,000,000 patents it becomes a vast numbers game and to the statistical-minded it would seem that whatever your field of technology, your chances of getting a patent are somewhat less than the likelihood of your infringing on existing patents.

This, of course, is something you would not knowingly do. But as we said above, there are traps for the unwary, and with our ballooning technology spawning nearly 3,000,000 patents, the matter of infringement becomes of increased complexity.

Strange as it may seem upon first consideration, the possibility of patent infringement is to be reckoned with even in instances of machine maintenance and reconstruction. This isn't of as common knowledge as it might be, and only rarely do we hear of it. But it has been a matter of extensive litigation, and when you are confronted with the problem, your patent attorney's knowledge of court decisions can be an invaluable asset.

When you buy a patented machine you acquire the implied right to use the machine. And you, as purchaser of a patented machine, are permitted to make the reasonable repairs necessary to keep the machine functioning.

However, in the absence of an express agreement, your right to use and repair does not include the right to reconstruct. This is because the implied license attached to your purchase of the machine does not include a license to make the machine.

Under certain circumstances, you could be held liable in damages to the patentee, and you could be enjoined from using the machine further, although bought and paid for. These points could be particularly sticky in the case of a machine you had leased instead of purchased.

It is plain to see, therefore, that the questions: What is repair? and, What is reconstruction? are of major importance.

A study of court decisions on the question of what constitutes repair and what constitutes reconstruction shows that there is no cut and dried answer, and that in a given case the answer depends upon the pertinent facts and circumstances peculiar to the case.

In another aspect of the repair-reconstruction problem, the courts have generally held that you, as purchaser of a patented machine, infringe when you effect an actual alteration of the machine. When this constitutes what they term "loss of identity" the courts are referring to the fact that you cannot claim a mere repair when your machine as altered does not conform to the original.

Another area of concern involves your purchase of replacement parts for a patented machine from some supplier other than the manufacturer of the machine. The question then is, are the replacement parts covered by claims allowed in the machine patent? If the answer is yes, then again arises the question of infringement and your liability.

Litigation, particularly unsuccessful litigation is an expensive luxury. When, and if, you have a problem of this nature run, don't walk, to your patent attorney or company patent counsel.

E. Willard Pennington

Editor

UNIVERSAL JIG AND FIXTURE COMPONENTS AND CLAMP ASSEMBLIES

Shown here are a few of more than a thousand different items in regular steel and stainless steel —the largest and most complete selection in the United States—now available from Universal Engineering Co. Write today for your copy of the complete, new catalog.

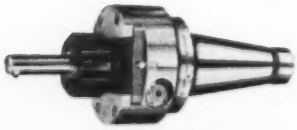
213

OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS

Floating Chuck

Standard Collet Chuck

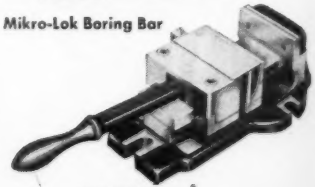
Mikro-Lok Boring Bar



Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing



Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 8, MICHIGAN

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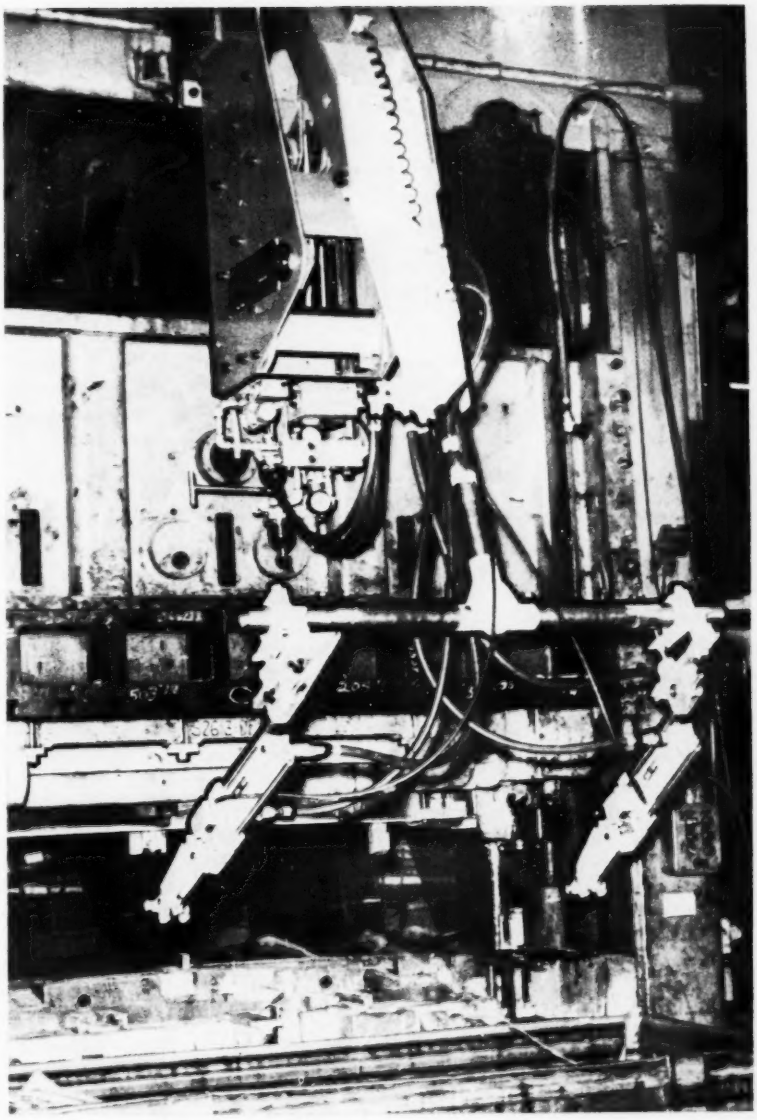


Fig. 1. A swinging arm at the end of its backstroke. In handling this wide part, Press Automation Systems, Inc., has equipped their swinging arm with two jaws.

How To Choose A Press "Arm" . . .and set it up

There are several methods of removing formed sheet metal parts from a press. This will help you know what to look for in a swinging arm if it is to be best suited to your operation.

HERE ARE QUESTIONS AND ANSWERS from an interview with a man who has been buying and using press unloader arms for 25 years. We were fortunate to have time with him since he is putting in over 100 hrs/wk setting up 1961 automobile production lines. He is

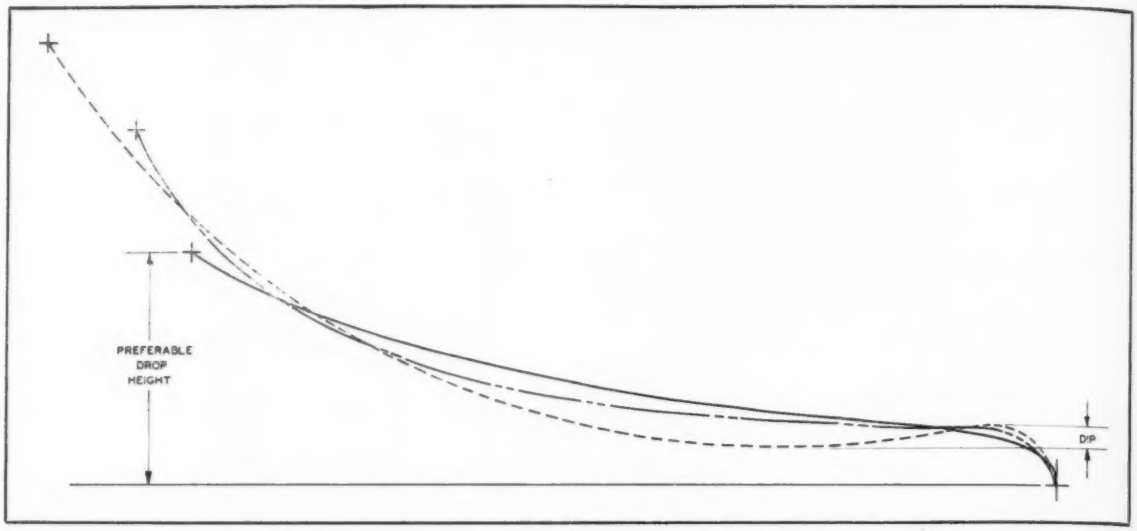


Fig. 2. An optimum pull-out stroke will feature: 1) no dip, 2) nearly straight travel, and 3) a low drop-height.

Mr. Authority himself when it comes to press unloading.

Q. Are press automation units difficult to adapt to a press?

A. No. Once the pad is fastened to the counter of the press, it's a simple matter to apply the unit. An H frame (furnished) is bolted to the pad. You simply pick up the "arm" and hook it on the frame and two 5/8 bolts at the bottom give a stable mounting.

Q. How do you arrive at the position of the pad on the press?

A. By the size of the press or the arm. Only a few simple dimensions are needed.

Q. How about the height? Do you have enough adjustment to meet all conditions?

A. An arm can take care of almost any height with its telescoping tube.

Q. After mounting what remains to be done to get started on automatic unloading?

A. The electrical connections must be made; it's just a plug-in proposition. These units are completely self contained electrically, but you have to "time" them with the press stroke. The press crank has a 360° rotation; when it "bottoms" you have rotated 180°, and the die is closed. You then go on around to 230 or 240° when the die is beginning to open. At this point the limit switch which will actuate the arm is set. When the press is sufficiently open, the arm whose jaws have been arranged to close at the proper time, will take the part up and out. Speed and time are the only concerns.

Q. How do you control the speed?

A. Speed control is on two movements: the jaw speed and the speed of the pull. These are controlled by variable orifices on the exhaust valves.

Q. How long does it take to set up an arm?

A. We quite often do it at noontime. We move an arm and have it running in half an hour.

Q. With adjustments too?

A. Yes, moving it, adjusting it, and making it ready to run. We do this regularly.

Q. On what occasions?

A. Well, our cranes span two press lines having as many as 14 presses each. Let's say half the dies have to be reset (replaced with others) at a particular time. The cranes are mighty busy at this time getting ready for the next shift — moving dies and arms. These features would be even more important to a small manufacturer.

Even so we're buying enough arms this year so we won't have to move them between shifts. We've found they pay for themselves — being as easy as they are to move. We'll pay them off over our seven year amortization program. We'll be saving at least $80,000.

Q. What about setup tolerances?

A. There's a simple method of setting up a job. The pull control valve has a manual override that can be tripped to leave the arm in the up position. Thus with the press blocked and a part in the die we trip the manual override. The press cycles and the part is raised to grab-height. About 80% of the parts we pull are lifted from the die cavity with a built-in air cell. The arm is allowed to descend slowly and is adjusted for height by its telescoping feature so the jaw will grab the part properly. I have standardized on a 3″ jaw opening, but many plants use 1 or 1½″ openings. This is too close, however, when you're running 600-1200 pieces/hr; there is bound to be vibration and the part may still be moving when you grab it — so the larger opening is better. If on certain operations you might miss, you could open up as much as 6″.

Q. Then how do you control the jaw release?

A. Well, let's say the press went around 250°. I would then trip the limit switch on the cam. At that time I would adjust the timing relay, by a finger adjustment, for the length of time I wanted

the jaw to hang on to the panel. At the end of the time cycle, the relay "drops out" and de-energizes the jaw control valve. The jaw then releases the part and the arm continues to the end of its stroke.

Q. The jaw can be set to open at any place in its stroke?

A. That's right.

Q. What governs where you drop the part?

A. The influencing factors are many. You might want to drop the panel on the turnover device of an automated line; here you would want a whip-action, so a fast pull and an early release would suit best.

Another instance would be when you are going to drop the part on a slide table, and let it slide to the next press. In most cases die-heights are about the same. You would have to pull hard, and hang on to it long enough to gain inertia so it would slide — maybe 18′. In another instance you might have to "pull" a part in relatively close quarters, or drop it carefully on a belt conveyor, or swing it near a man feeding another press. Under these circumstances we do what we call a "soft pull." We pull it slow and control it so the arm moves out, and almost to a stop before dropping.

Then, where we want to turn the part over we pull at a medium speed (depending on the part size) and hold on for the full stroke. The moment you hit top, you release and the part will flip over.

Q. How do you go about choosing the right size of equipment?

A. The size of the press and the panel to be pulled dictates the size of the press unloader. Medium sized units are used in perhaps 60% of our installations. But for presses where the bed area is around 100″ front to back (large quarter-panels, a roof panel, or a floor panel), we wouldn't consider anything but the large units. These panels are of heavy stock (22 gauge) and will weigh 100 lbs alone.

Q. In other words, the make of the press doesn't make any difference?

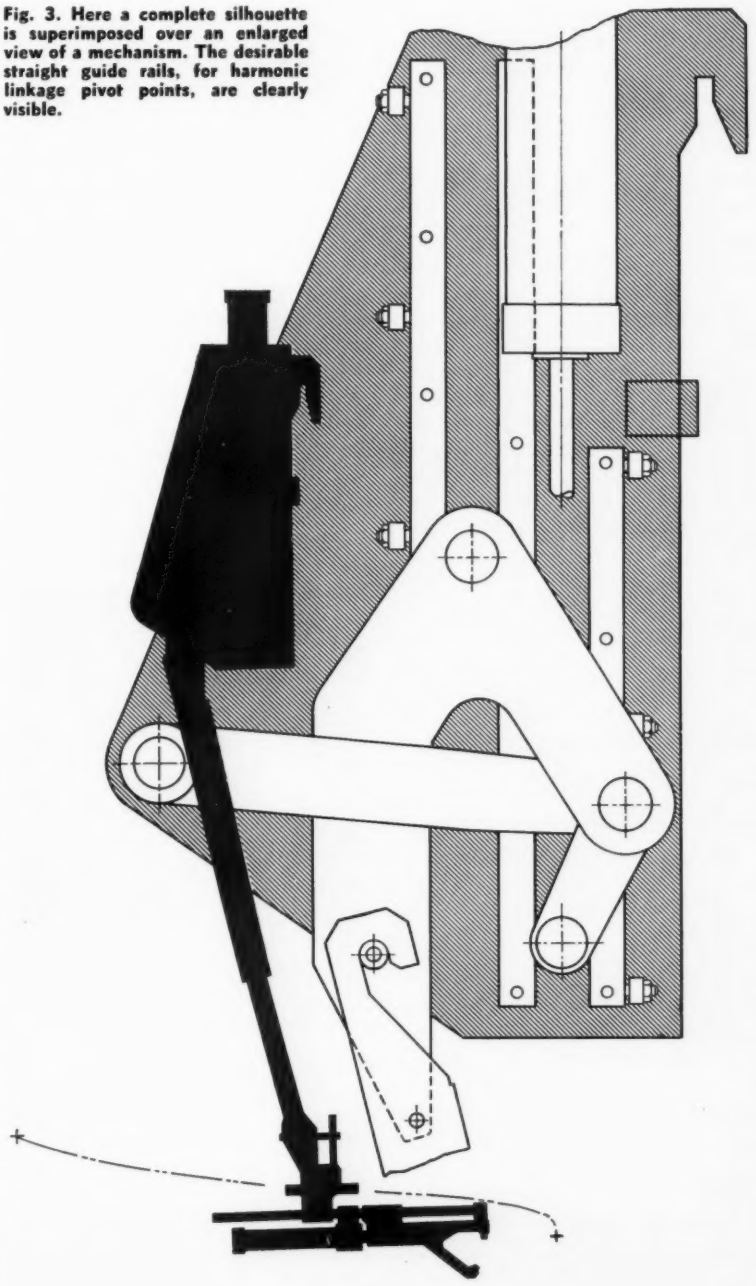
A. That's right. It's the size and weight of the part that counts. You should however buy an automation unit with clean lines having no complications outside the "envelope" to cause interference. I have had some that gave interference causing me to burn off the press motor mount and to "gusset" here and there, in order to make the installation. Too, die setters and crane operators have little respect for your equipment. They are murder on any protrusion.

Q. What headaches are there peculiar to any press arm?

A. Well, we have jobs where we have to discharge parts out of the front of one press and out of the back of another. When they are spaced too close the arms swinging towards each other may interfere. This is not serious. It just takes better planning.

Q. In order to keep press operating pressures balanced I sup-

Fig. 3. Here a complete silhouette is superimposed over an enlarged view of a mechanism. The desirable straight guide rails, for harmonic linkage pivot points, are clearly visible.



pose you have to set up on center?

A. Yes, it's best to mount unloaders in the center of the press, but we do use offset brackets if a part is to be grabbed off-center.

Q. What about maintenance?

A. Our arms are lubricated twice a month. This amounts to filling the lubricator reservoir. I have many arms in my plant and can't afford to tie people up on breakdown repair. We try to buy units that are the most trouble free.

Q. What do you look for in the travel-path of an unloader arm?

A. Three very important things: 1) no dip, 2) a near straight line motion, and 3) a slow rise for a short drop distance.

Q. Are there other types of unloaders, and which type do you prefer?

A. Yes, there are two basic types. The Swinging Arm Unloader which we have been discussing and the Straight-Line or Horizontal type Unloader. I have had considerable experience with both types. If you check the industry, you will find some rather elaborate motor driven unloaders which are quite expensive not only initially, but maintenance wise as well. At this plant we are 95% air and 5% motor.

When I choose a handling policy for a plant, I prefer the best and cheapest way. Therefore, I recommend air driven Horizontal Unloaders which can pull everything large or small and operate on less than 60 lbs. air pressure. The only real drawback is that they clutter up the floor and have to be pushed out of the way constantly. They block the accessibility to the one side of the work area.

There will always be the isolated job where a horizontal is best suited.

Today my preference is the Swinging Arm since they are now available with a straight line unloading path, operate at a low air pressure, and at the same time, present a streamlined appearance. Aside from efficiency, appearance is also important, as I find my people prefer working with nice appearing equipment and the modern design of new press plants demand it.

Q. Are there any other desirable design factors we should look for?

A. Yes. You should look for an arm that won't knock itself to pieces with whip and shake. Rigidity is important?

Q. What design features mean the most from the standpoint of low maintenance?

A. A unit built with a vertical rail in place of cam actuation. This seems to eliminate nearly all maintenance. Where you have a curved track, excessive friction and wear take place.

Q. Do most of your units use air cushion cylinders?

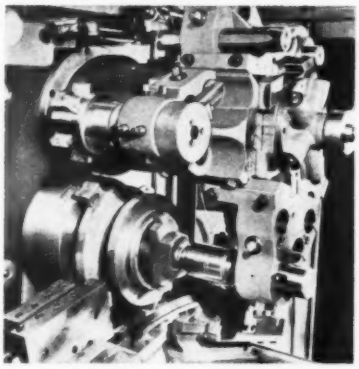
A. No. Cushioning is done through the control of air exhaust. Also a pressure pop-off valve is a good control feature.

Q. We have covered about everything, I hope. Does anything else come to mind in the way of advice to our readers?

A. We haven't touched on the cost of operating a unit at high air pressure. It can be prohibitive. Some units are available that operate on a 40 lb pressure with uniform efficiency throughout the complete stroke. This can result in a savings of at least half the money spent in operating units that require 80 lbs (or more).

Extra copies of this article are available while supply lasts. Write Tooling & Production Magazine, 1975 Lee Road, Cleveland 18.

Combined Operations Up Valve Quality and Output



Seat ring driver used on a Warner & Swasey 2-AC chucking automatic to handle an assembly operation during automatic machining.

By combining an assembly operation with an automatic machining cycle, Minneapolis-Honeywell Regulator Co. has increased both production and quality of precision regulating valves.

A Warner & Swasey 2-AC single-spindle chucking automatic, equipped with a three-jaw air chuck, handles all machining on the cast iron parts, using only three of the five available turret stations. This includes tapping a 6-5/8″-10 pitch thread.

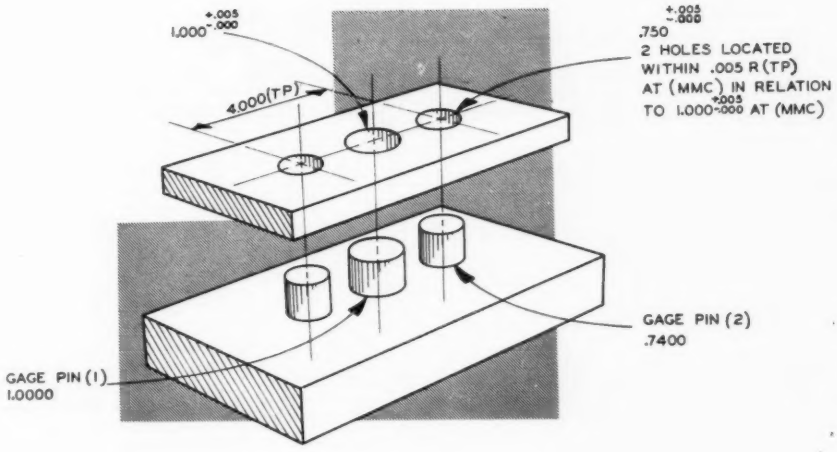
A cycle stop pin inserted in the 2-AC index control drum stops the automatic cycle between Sta. 3 and 4 to permit a 6″ dia bronze seat ring to be started by hand. Pressing the cycle start button then returns the machine to automatic operation, with Sta. 4 automatically driving the seat ring home and Sta. 5 finish boring to a 0.003″ tolerance, forming the 60° valve seat in the bronze insert.

The seat ring driver consists of a standard friction tap chuck with a special spring-loaded drive plate. As the turret feeds toward the chuck, two ears on the drive plate engage driving lugs on the seat ring. The spring action of the drive plate permits slight longitudinal movement and eliminates possible damage to the turret drive mechanism as it feeds forward to its positive stop. Feed rate is equal to the 10 pitch thread on the seat ring or 0.100 ipr. Spindle speed for the driving operation is 292 rpm.

An Editor Interprets (TP)

Part II

by William E. Hoffman
Managing Editor



What TP (True Position) does:
- Allows interchangeability without use of small tolerances
- Provides more area for location of hole center
- Speeds determination of tolerances
- Simplifies tolerances of complex parts
- Overcomes accumulation of tolerances
- Gives more adequate location
- Interprets tolerances for both production and inspection
- Permits use of easily made gages that simulate mating part
- Reduces scrap caused by other tolerancing methods

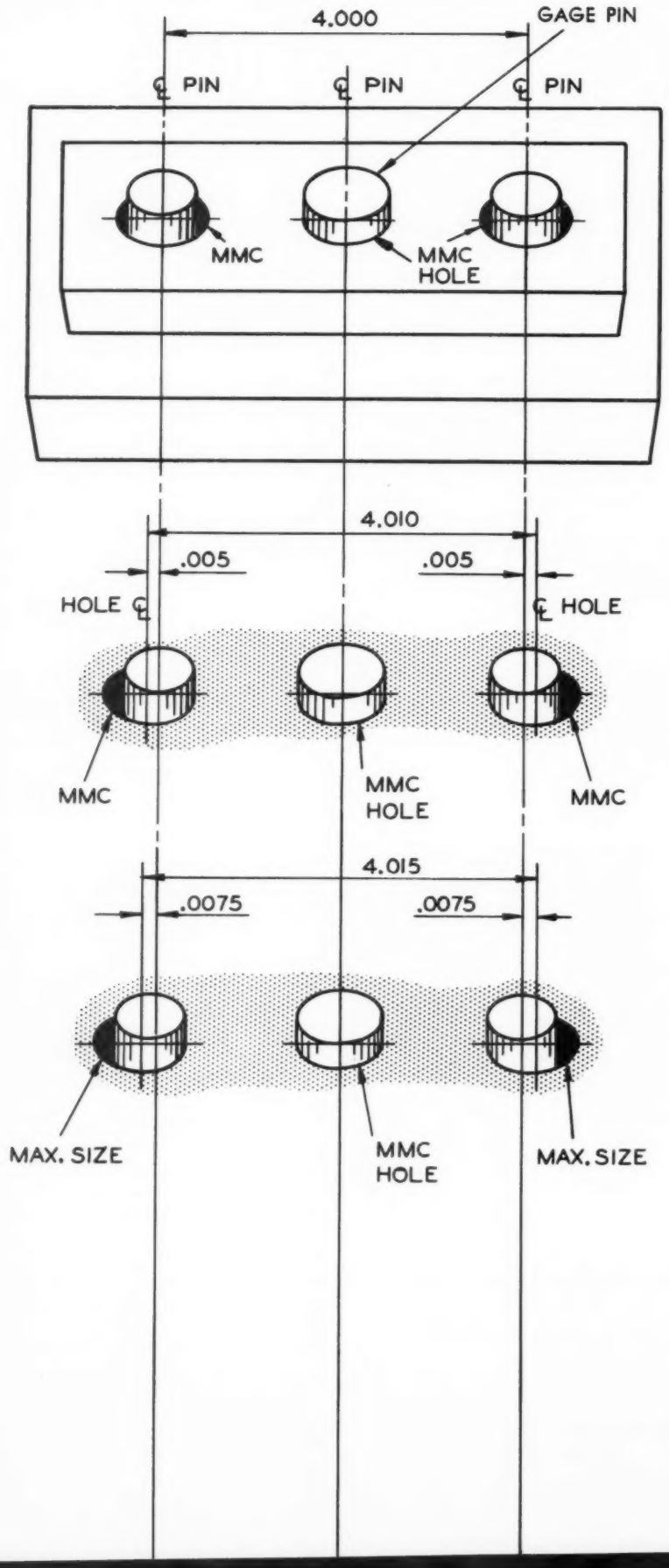
Part I appeared in the October issue of Tooling & Production. Copies are available while they last.

In continuing our interpretation of True Position Tolerancing this issue covers the functional gaging of a hole pattern. A number of hole relationships are depicted; in each instance hole sizes and locations, in respect to each other and to the center hole, are acceptable. Parameters of acceptance are established by the one hole specification note.

Various hole relationships shown here are but a few of the many possibilities for an acceptable part.

In going over these the reader should keep in mind that the True Position Tolerance specification is at maximum material conditions. Additional positional tolerance is available as holes go away from MMC up to their size limit.

Also, it will be helpful to keep in mind that the same gage is used in all views. To simplify further, gage tolerances have not been considered.



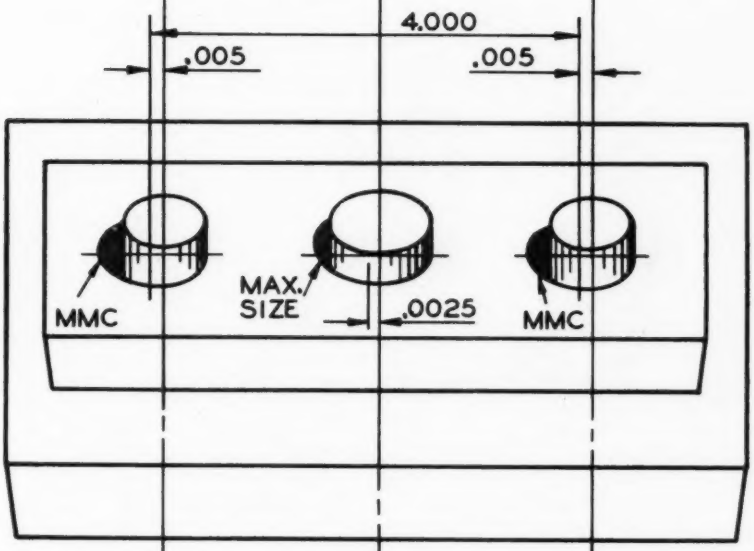
View A. Not only does the part here check out, it appears to be "perfect" as to hole location. Of course hole size must be established as being within tolerance before the part can logically be tried on the gage.

View B. Here, as in all views, the holes are located within TP specifications. This is the limit however that the centers can move while holes are at MMC. Note that the center hole in each of the first three views is a "perfect" fit with the pilot pin.

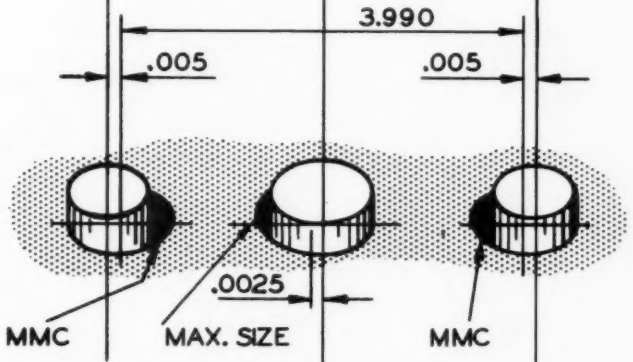
View C. Conditions here find the outside holes at the maximum diameter (each 0.005 larger than MMC). This allows for a 0.0025 additional positional tolerance, as can be seen by the 4.015 dimension.

Part III will appear in the December issue of Tooling & Production.

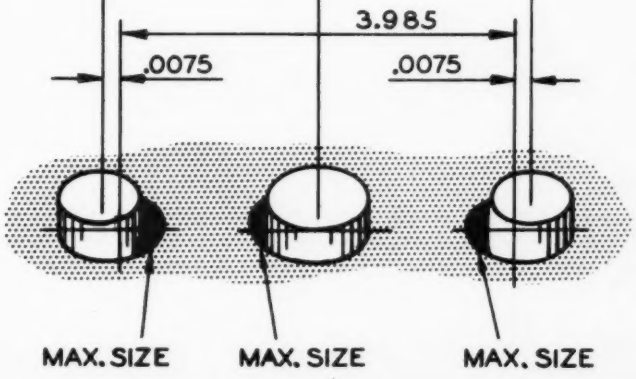
View D. This is to show that when the pilot hole is at maximum diameter, little additional positional tolerance may be available (in some cases). This is because of the relationship of the three holes; they are all to one side of the gage pins. TP is relative to the pattern and in this case there is little deviation.



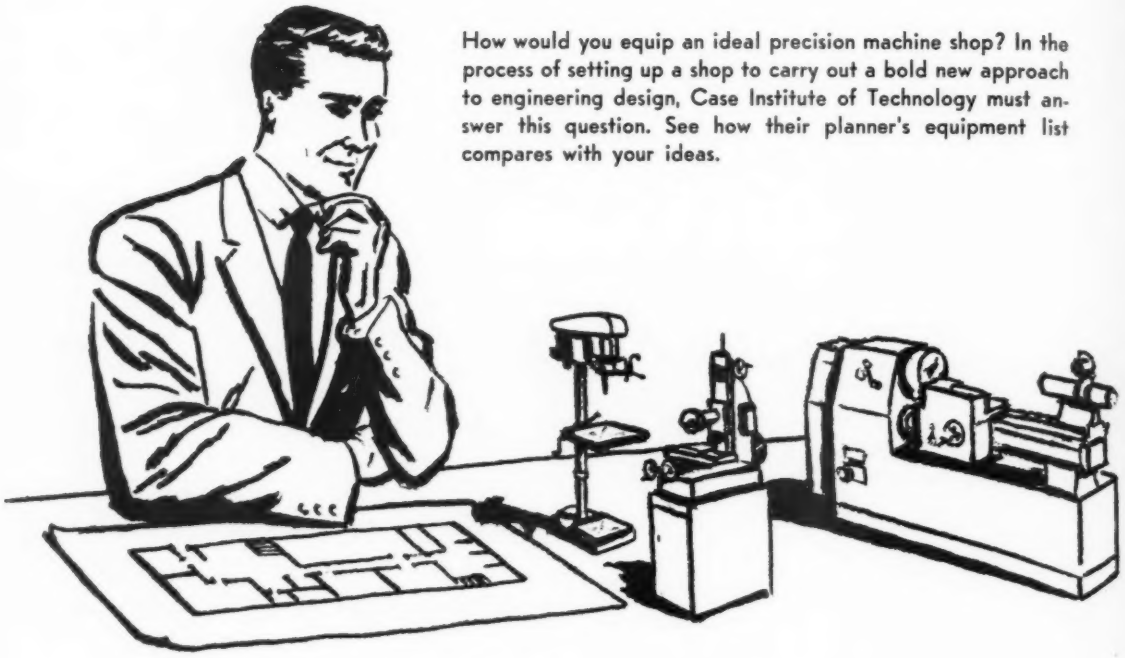
View E. Here again the pilot hole is at maximum diameter which permits the necessary shift to allow the left hand hole to go over the gage pin, even though the holes are at MMC.



View F. If the outside holes are at their maximum diameter, as well as the pilot hole, an additional out of position condition can exist. Here it's 0.0025 is in addition to the 0.005 available in View E.



Machine Tools Go To College



How would you equip an ideal precision machine shop? In the process of setting up a shop to carry out a bold new approach to engineering design, Case Institute of Technology must answer this question. See how their planner's equipment list compares with your ideas.

by Charles Weiner
Assistant Editor

TOUGH PROBLEMS ARE DAILY FARE for metalworking men, but few are faced with the job of selecting and buying an entire shopful of precision equipment at one time. Tackling such a task is Carl Petri, technical associate in charge of Case Institute of Technology's soon-to-be-opened precision machine shop. The shop is part of the Cleveland institution's new half-million dollar Engineering Design Center, headed by Dr. James B. Reswick. It will be capable of handling small, precision work made of any material.

Selection of new types of machines and the specification of particular models requires a careful analysis of the job to be done, the capabilities of the machine, and the economic justification for acquiring the equipment. In Mr. Petri's case, the problems are compounded because he's considering not just one machine, but a representative assortment of diversified equipment. Starting from scratch, he must equip the shop so that it can handle a wide range of work from the outset. The job of specifying is further complicated because it will be a one-of-a-kind shop. Work will be in wood, plastic, and any metal from soft iron to the space age "exotics." Tolerances in tenths, with an occasional splitting of tenths, will be expected. The only limitation is size; most jobs will be in the "size of a fist" range.

These capabilities are necessary since the devices made in this shop will be the culmination of a design process involving all facilities of the Design Center. The Center will include machine shops, testing laboratories, and service facilities arranged to promote maximum exchange of ideas between various design teams. Each team is made up of faculty, students, professional engineers, and technicians. They will follow a design through from inception to drawing board, and on through machining to the finished device. Emphasis will be on small devices, including instrumentation and controls — the challenging problems are in this area.

The Design Center was established because many educators and industry leaders feel that engineers were being trained to handle

only part of the design process without seeing over-all problems. As a result of the incomplete picture, engineering school graduates are sometimes afraid to tackle new jobs, or feel they "know it all."

By integrating all phases of the design process under one roof, Case hopes to give the fledgling engineer a chance to make mistakes and to understand why he made them. Another aim is to teach him the limitations and power of the techniques he learns in the classroom and laboratory. In the process, he'll become acquainted with the operation and capabilities of modern machine tools and how they fit into the design and production picture. Development of his attitudes, professional understanding, and sense of responsibility will make the young engineer more useful to industry.

While workmen put the finishing touches on the shops, offices, and labs of the Design Center, Carl Petri works amid catalogs, salesmen, and memories of September's Machine Tool Exposition. Like other show visitors he looked, compared, and learned. Now he's trying to decide which equipment is best for his needs.

He has listed the equipment he thinks will be necessary to put the precision shop "in business." Emphasis is placed on units which can give high precision without concern for high capacities. Larger capacity machines for rough work, and equipment for maintenance, are presently available in a general machine shop.

Budgets are always a major problem. A rough estimate of the cost of the listed machines approaches $78,000 without figuring in the necessary tooling. Only $55,000 is available as a budget. Some of the desired equipment and tooling may have to be added later. But this alternative would limit precision shop ability, so other solutions are being sought. Cooperation from interested machine tool builders might ease the situation.

On the next page are Petri's equipment recommendations. See how your ideas compare with his. Remember, the equipment is for small, precision parts made of any material. And don't forget the budget.

. . . continued on next page

Plans for Case Tech's new Engineering Design Center are studied by Dr. James B. Reswick (left), and Carl Petri. Precision machine shop will be located under balcony on which they stand, so visitors can observe the machine tools in action. The shop will be air-conditioned for better control of tolerances on temperature-sensitive materials.

Machine Tools Go To College . . .

continued from preceding page

Here's what planners at Case Tech think they'll need to equip their new precision machine shop. Familiarize yourself with what they hope to accomplish, and then see where you might change their projected purchasing. Costs are approximate.

Toolmaker's lathe (12″ swing, heavy duty) — should have infinitely variable speeds, must be capable of working to tenths, and rugged enough for heavy cuts in tough materials, or for form tool cutting of contours and radii. It must also have a good selection of thread changes from about 4 to 120 TPI. — $9000.

Toolmaker's lathe (10″ swing, light duty) — a high speed lathe, capable of doing work similar to that of the 12″ model, without heavy cutting ability. It can be used either to augment or replace the heavier unit. — $5500.

Jeweler's lathe — work load will be limited to minute parts, similar to those in watches or instruments. — $1000 with tooling.

Vertical mill — a versatile machine with head capable of tilting on two axes. Should have attachments for intricate milling work — $1700.

Horizontal tool room mill — to be used for plain milling, and may be a later acquisition. — $3000.

External grinder — may be added later. Some small external pieces may be ground on a universal grinder; others on the external grinder now in the general machine shop. — $3000 to $4000, depending on attachments.

Surface grinder (small capacity, 6″ x 18″ or less) — should be capable of working to tenths. Ball, roller or Teflon ways are preferred. Decision is yet to be made on hydraulic vs. hand feed, and type of spindles. — $3000 to $4000.

Universal grinder — primarily a tool and cutter grinder, this unit should also be capable of grinding parts internally and externally, with steep or long tapers, and should be able to generate helical forms. A motor-driven work spindle which may be tilted, offset and rotated for radius grinding, is necessary. Three-way spindle positioning is desired. — $5500.

Disc and belt grinder — for grinding and polishing non-critical surfaces, and removing burrs from stock or finished parts. A relatively inexpensive machine, having provision for dust removal, is desired. — $200.

Honing machine — for superfinishing bores to close tolerances while correcting out-of-roundness or other machining defects. Accessories to include external honing fixture. — $900.

Lapping machine — a 10″ dia bench model, with disc for producing flat surfaces with high finishes. — $300 to $400.

Jig borer — requirements include 10″ x 18″ table travel, dependable accuracy of table positioning and machine geometry, preferably with infinitely variable spindle speeds and power quill feed both up and down. Machine should be rugged, yet sensitive enough to handle small diameter holes (0.010″ to 0.015″) should the setup demand it. Two methods of measurement are being considered — positioning of the table by direct reading, through a precision leadscrew, or by optical means. It will be used for drilling, reaming, boring, light milling, inspection; and for jig grinding with an attachment. A precision rotary table with sine plate mounting or tilting feature is a necessary accessory for the variety of work anticipated. — $14,000.

Sensitive micro drill press — must be able to drill holes down to 0.004″ or possibly 0.001″ dia. Must have provision for X and Y positioning of work or a table capable of accurately supporting an auxiliary table. — $1000.

Micro drill sharpener — small unit for sharpening drills from 0.004″ to 0.080″ dia. — $300.

Engraving machine — for graduating dials and scales, lettering instruction labels for equipment and for drilling printed circuit boards. — $400.

Electrical discharge machine — to machine electrically conductive materials when the material is hard, or when the shape of the machined cavity is such that conventional methods of machining are impractical. Tolerances of a tenth are desired, where possible. — up to $10,000.

Ultrasonic machine — for operations similar to those done on electrical discharge unit, except that material will usually be a non-conductor or semi-conductor. — $2000.

Sheet metal equipment — a shear, finger brake, rolls and punch are included. All must be hand-operated, having at least a 24″ wide capacity. Principal use will be for chassis work for electrical components. — $1000.

Micromanipulator — for positioning micro-size parts for viewing under microscope, or for assembling parts too small for conventional techniques. — $500 to $1000.

Toolmaker's microscope — an inspection tool for measuring close-tolerance angles, radii, threads or linear dimensions of micro-size parts. — $2000 to $3000.

Electronic Gages — for height gaging, differential gaging and rotary indicating for jig borer work setup. — $1500.

In addition to the above, precision equipment such as gage blocks, master angle blocks, a granite surface plate, granite parallels, granite angle blocks, compound magnetic sine plate, cross-slide rotary table, sinometer, surface analyzer, and other accessories will be acquired as the need arises at a minimum approximate cost of $10,000.

Also to be included in the shop are a shaper, lathe (for fixture "roughing" operations), drill press, carbide tool grinder, and an optical comparator. These existing machines will be transferred from the Mechanical Engineering Shop.

From the Cover:

THIS MONTH'S COLOR COVER portrays Micromatic Hone Corporation's setup for Microhoning connecting rod bores at a gross rate of one every five sec, while generating geometric accuracies within 0.0002". The machine is their single spindle horizontal model 5HX16 Hydrohoner adapted to horizontal stack Microhoning.

Far from being limited to connecting rods, the process can also be applied to bores of rocker arms, pinion gears, milling cutters, and other parts whose bore lengths are rather short in relation to their diameters. All that is required is that the parts be stacked adjacent to each other so that they can be Microhoned as though they were one long part with an interrupted bore.

The accompanying illustrations show two workholding fixtures positioned on a common table. Each fixture holds eight workpieces. While one set of eight rods is being Microhoned, the second fixture is in the load-unload position. The fixtures exchange positions as the table indexes 180° at the end of the cycle.

Based on a total cutting cycle time of about 35 sec, an average of 0.004" stock is removed from each of the eight bores (2.423" ID x 1¼" long), while straightness and roundness are held within 0.0002" and the required finish is generated. Adding five sec for indexing, eight parts can be completed in 40 sec at full machine capacity.

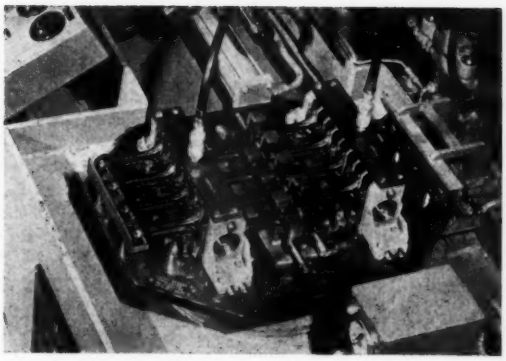


Fig. 1. Each of the two fixtures carries eight connecting rods with their large ends in alignment. To a cutting time of 35 sec, five sec are added for indexing.

Horizontal Stacking Speeds Microhoning

Horizontal "stack" Microhoning results in higher production rates at lower equipment costs, greater abrasive life through the use of longer stones, and less setup and maintenance time because of the single spindle operations.

The machine's hydraulically-actuated spindle-in-quill feature permits rapid stock removal at close tolerances because the reciprocating weight is reduced, providing maximum input power and minimum spindle eccentricity.

The head unit has a 16" withdraw permitting full use of the maximum 16" spindle stroke. This leaves ample room for complete withdrawal of the tool for table indexing and workpiece removal.

The transmission offers three speeds which can be varied to handle a greater range of bore diameters and material.

Conveniently-mounted, electrical and hydraulic control panels permit easy selection of manual or automatic cycle, and control the stroke speed and rate of tool expansion. A position indicator panel shows exact stage of honing cycle by means of lights.

An automatic stonewear indicator and associated controls provide visual indication of abrasive life, and automatically stop the cycling when the abrasives are worn down.

An integral part of this operation is the air gaging system. With each stroke of the tool an air cylinder moves the gaging plug into position to make a measurement after the part reaches a predetermined size. Size repeatability is easily held within a 0.0003" tolerance.

The tool is a special type which uses plastic guides to position the parts properly before the abrasives pass through the bores. By using abrasive sticks which are about four times the "normal" length, greater abrasive economy and more parts between stone changes are realized. end

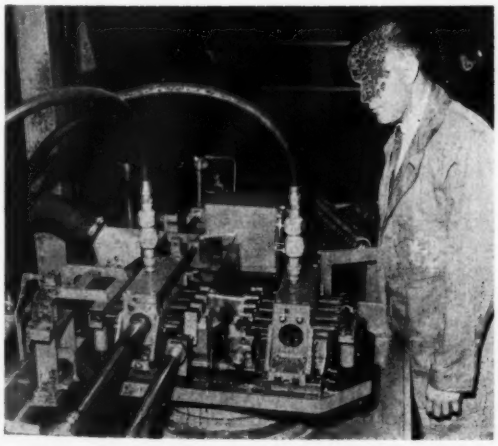


Fig. 2. One fixture is unloaded and loaded while eight rods are being processed in the other fixture. For each cycle the table indexes 180°.

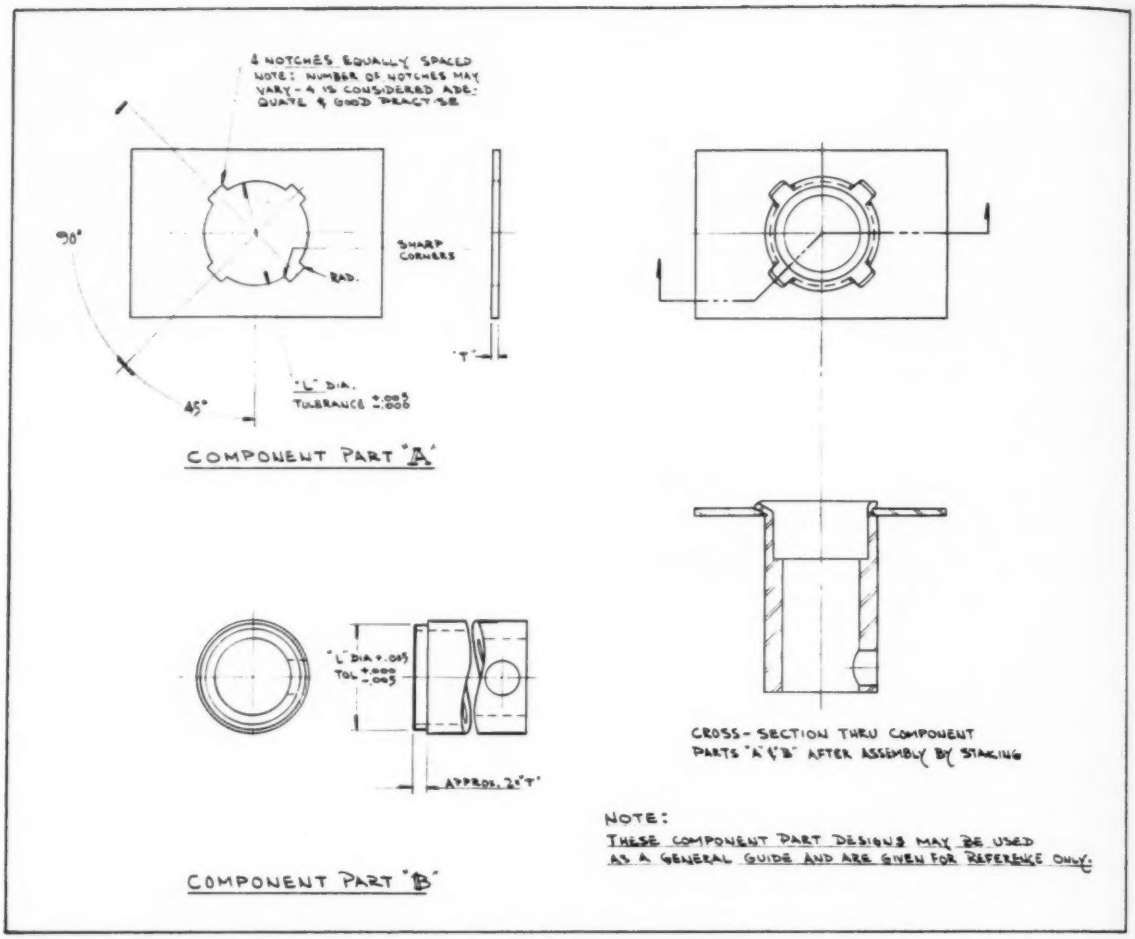

4 NOTCHES EQUALLY SPACED
NOTE: NUMBER OF NOTCHES MAY VARY - 4 IS CONSIDERED ADEQUATE & GOOD PRACTISE
90°
SHARP CORNERS
RAD.
"T"
45°
"L" DIA.
TOLERANCE +.005 -.000
COMPONENT PART "A"
"L" DIA +.005 TOL +.000 -.005
APPROX. 2"T"
COMPONENT PART "B"
CROSS-SECTION THRU COMPONENT PARTS "A" & "B" AFTER ASSEMBLY BY STAKING
NOTE:
THESE COMPONENT PART DESIGNS MAY BE USED AS A GENERAL GUIDE AND ARE GIVEN FOR REFERENCE ONLY.

Fig. 1. For purposes of assembly by staking, these design details for parts "A" and "B" can be varied to suit a great variety of components. The prime considerations are a number of contacts of sufficient area to insure accurate positioning and rigidity.

Multi-Station Staking Die

by Walter L. Stein

Mr. Stein is Chief Tool Designer at the Modine Manufacturing Company, Racine, Wisconsin.

THE STAKING OF PRODUCTION parts is an inexpensive yet highly effective method of assembling various components. Staking is the operation by which parts are assembled or secured, one to another, by deforming under pressure the mating areas in either or both components. The interlock thus effected provides a rigid assembly. A staking die being run in a punch press can successfully accomplish this operation.

Parts to be assembled by staking should incorporate design features equivalent to those shown in Figure 1.

Cost of manufacture by this process is much lower than by other methods such as welding or brazing. Here, for example, is an actual cost breakdown in dollars and cents, of what a manufacturer of heating equipment saved in tooling costs, and an estimate of assembly time saved.

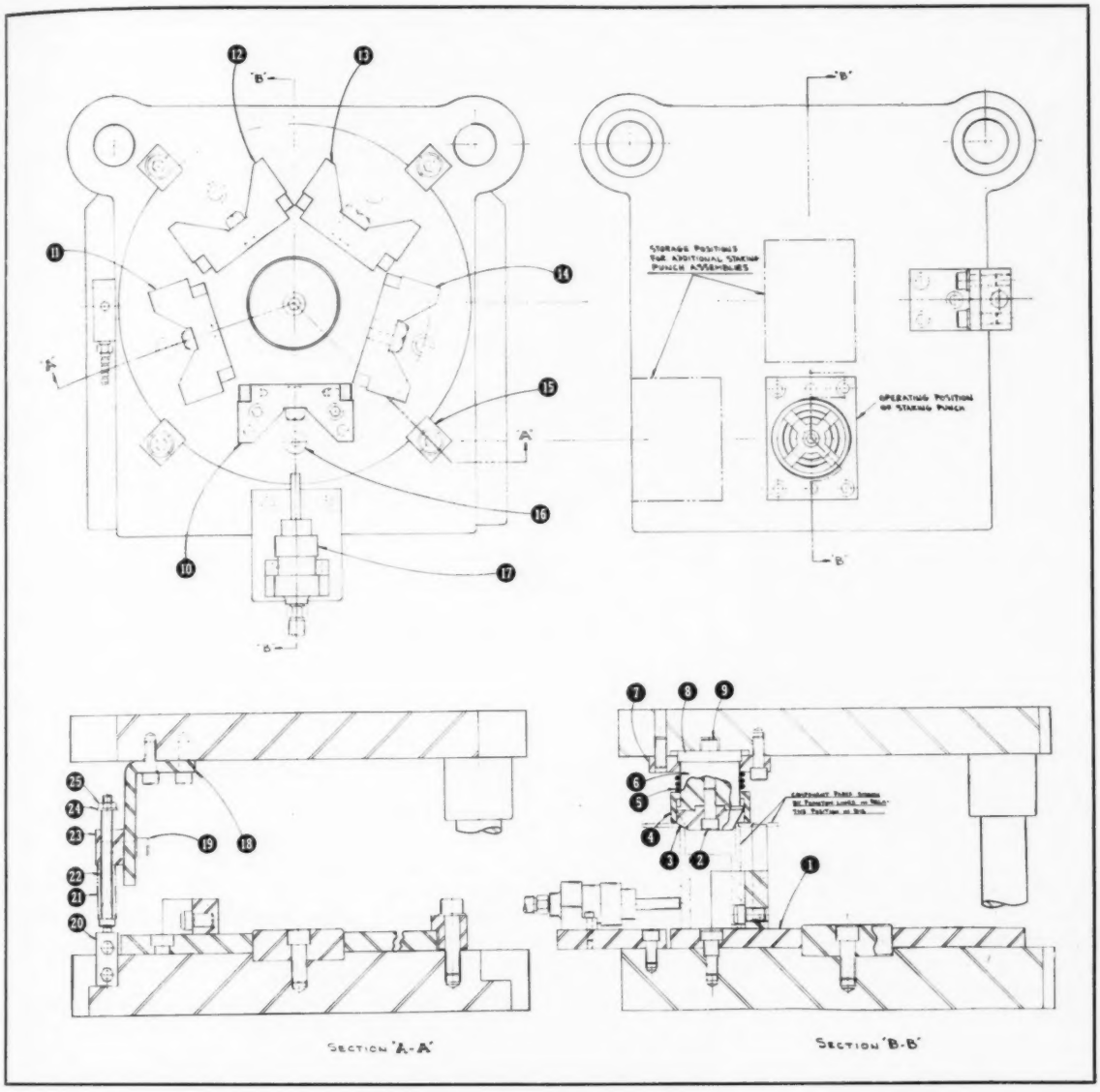

STORAGE POSITIONS FOR ADDITIONAL STAKING PUNCH ASSEMBLIES
OPERATING POSITION OF STAKING PUNCH
SECTION 'A-A'
SECTION 'B-B'

Fig. 2. This multi-station staking die accommodates a range of workpiece sizes, is fast working, and effects impressive savings in assembly time.

Original Proposal

One semi-automatic fixture to braze mounting bracket, water connector and copper tubes	$3572.00

Second Proposal (accepted)

One staking die to assemble mounting bracket and water connector	$1166.50
One semi-automatic fixture to braze copper tubes to water connector assembly only	$1650.00
Total 1st proposal	$3572.00
Total 2nd proposal	$2816.50
Total Savings	$ 755.50

Assembly time savings of second proposal over first proposal was conservatively estimated at 50%.

If the function of the part is such that it will lend itself to this type of assembly, then obviously staking is the correct solution. However, as practical and desirable as a staking operation may be, it is no better than the production methods used in manufacturing the parts. Costs saved in product design can be completely wasted if proper tooling is not provided.

Figure 2 shows the die that assembles the parts shown in Figure 1 by staking. It was designed to avoid and eliminate the troubles that were encountered in a previous die used for a similar operation. The earlier die was a production bottleneck. It had individual interchangeable v-block assemblies that had to be frequently changed and stored for each different part run. As far as setup time was concerned, this procedure was time consuming and the v-blocks were invariably being misplaced when not in use. A hand actuated clamping device made the die slow to load and unload, and therefore its operation

was far below peak efficiency.

In the new die of Figure 2, the staking punch (composed of details 2 through 9) has a tool steel staking insert (detail 3) with splines corresponding to notches in part "A", Figure 1. This staking insert forces the metal of part "B" outward and into the notches of part "A" and thereby provides a rigid assembly. This bond is further insured and completed when the chamfered diameter of punch body (detail 6) enters and flares out part "B". The stripper (detail 4) has two functions. It holds part "A" properly on the shoulder of part "B" before the staking operation, and also prevents the assembly from sticking to the punch after staking.

Featured in this new die are three unique design elements, the most prominent of which is a revolving v-block plate, detail 1, figuratively a "wheel of fortune." This revolving plate is composed, primarily, of v-blocks which were made of tool steel hardened and ground, and shown in Figure 2 as details 10 through 14. The v-blocks are screwed and doweled to the revolving plate which is also of tool steel, hardened and ground. The v-blocks were designed to accommodate all of the basic sizes of the cylindrically shaped parts and to accomplish the operational changeover in a minimum of time. This changeover is executed merely by loosening four clamps (detail 15), removing shoulder screw (detail 16), indexing plate to the desired position, securing shoulder screw, and tightening clamps.

Another element of design is an adjustable stroke air cylinder (detail 17) that allows for the variation in the size of parts, and is set up to function automatically with the operation of the die. This system speeds up and simplifies the clamping of the parts.

The third feature is an air valve actuating plunger (details 18 through 25) that is fully adjustable to compensate for the several different shut heights of the die. This plunger travels ahead of the staking punch on the down-stroke, remains depressed during part of the up-stroke and thereby insures the proper or suitable clamping action.

By consolidating the assembly operations (17 in all) into this one well planned multi-station die, a great saving was realized not only in the cost of additional dies, but in the cost of die-setting and handling time.

Extra copies of this article are available while supply lasts. Write Tooling & Production Magazine, 1975 Lee Road, Cleveland 18.

New Drive System

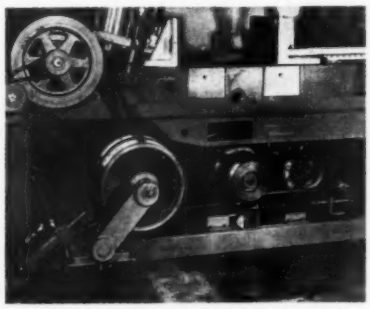
Adequate power for increasing demands has recently been incorporated into the power cut-out drive systems of the DoALL Co. New models have a 5 hp drive system, particularly important because of the new band saws being developed. Drive consists of a new motor mount, a redesigned variable speed unit, and a pivoted cutting head and spindle assembly.

This new system has been built so that components are fully compatible with each other and the new cutting rates.

Careful consideration has been given to trouble-free, low-cost maintenance, and particular attention has been given to the loader arm, which has a unique mounting providing positive constant force belt tension.

The 5 hp motor is mounted on a chassis that travels on ball bearing ways. A long spring maintains the proper belt tension, with less than 2% variation throughout its working range. It is adjusted by two easily accessible jam nuts. Also, the belts have been increased to 1 7/16" width and the sheave that rides on the sleeve has a Fabroid bearing to assure long, efficient service. The sleeve is faced with fiberglass for strength and Teflon for lubricity.

A number of other features are incorporated in the new variable speed drive. For instance rigidity is enhanced since none of the shafts are cantilevered. But the



speed change hydraulic cylinder (increased in size) acts along the center line of the drive and speed change is accomplished without bending or turning moments. The drive ratio is 6 to 1, providing band speeds from 50 to 350 fpm.

The hinge bracket has been strengthened and the bearing on the far end of the hinge pin, which might be subject to the heavier turning moment, has been doubled in size. The hinge pin bearing has also been changed from cast iron to a bronze while two anti-friction thrust bearings locate the hinge endwise.

Weld Nylon to Metal at Room Temperature

A two-step process has been developed by Plastic Associates, Laguna Beach, Calif., for chemically "welding" nylon to metal at room temperatures. It is expected to find widespread use in such applications as bonding nylon gears to metal shafts, or securing threaded screws or rods in nylon-and-metal assemblies. In such applications in the past, the self-lubricating qualities of molded nylon have generally required a mechanical interlock arrangement to prevent slippage between the nylon and the metal.

The new method makes use of an epoxy paste that chemically unites with the metal surface on which it is applied. A separate solvent solution applied to the nylon softens its surface and allows the nylon molecules to blend with the epoxy bonding agent as the latter hardens.

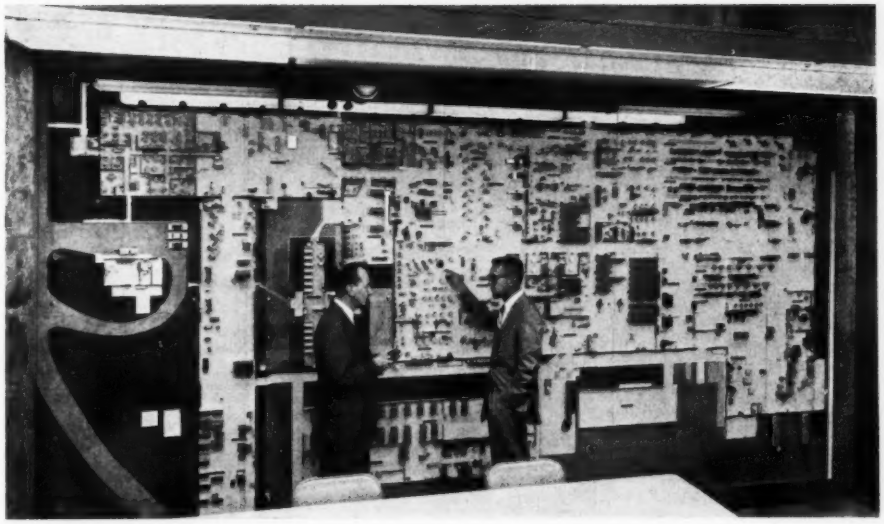


Fig. 1. A production problem is discussed in the vice president of manufacturing's office, where the scale layout model is mounted.

Up-Ended Plant Layout Model A Useful Management Tool

THE TYPICAL TABLE-TOP plant layout model usually plays an important part in reappraising production and material flow, but what is there to do with it afterwards? They are costly and represent a great deal of labor. Unfortunately, they take up a great deal of expensive floor space and gather dust at an almost unbelievable rate. This problem has been solved at Continental Machines, Inc., the Savage, Minn., plant in which Do-ALL machine tools are manufactured.

Best of all, in solving the problem they have found many additional uses for the model. This was achieved by simply building it vertically instead of horizontally. What could have ended up as an expensive white elephant, now is an important management tool used for a variety of activities.

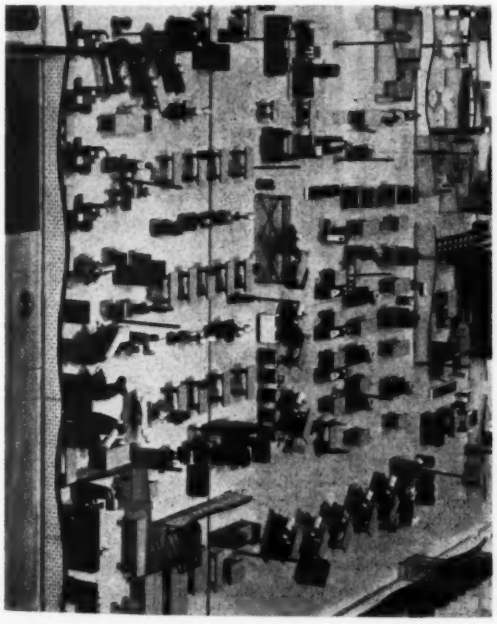


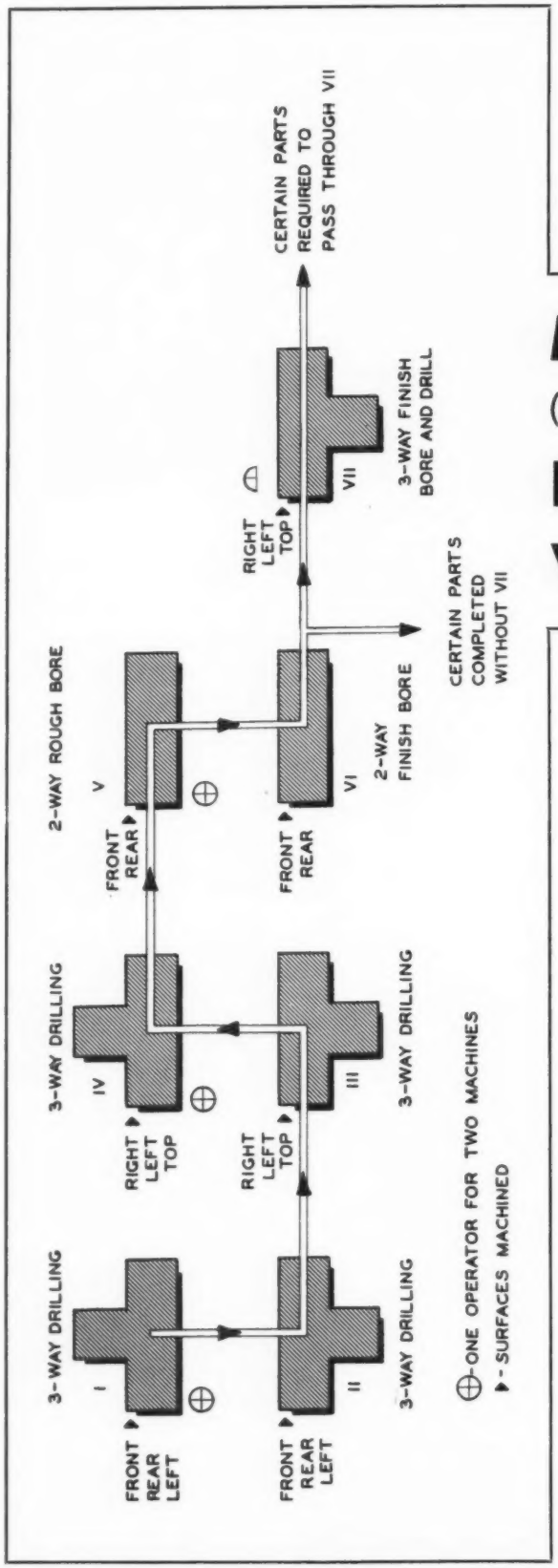
Fig. 2. One section of the plant, as shown on the layout board. Turn the page to get better perspective. Walking away from and to the left of the wall-size board gives the same effect.

The model fills one wall of the office of the vice president in charge of manufacturing. The individual models are all 1/4″ to 1″ scale and mounted with pressure sensitive bases on a plate glass backing. The color backing and aisles are on the panel behind the glass so they are not destroyed when the models are removed.

The wall mounting permits any degree of perspective desired. The viewer need only walk up to the model or back away to find the perspective that best suits the problem at hand.

In addition to the original purpose, which was a long range growth program, the model is used daily in many other activities. It has been used for safety programs, maintenance planning, foremen's meetings, and even in sales activity.

So that the model will relate meaningfully to all viewers, even those not familiar with plant layouts, great care has been used to make all of the individual models exact replicas of the actual machines. Viewing any area, as the attached photos show, is as close to being in that actual area as Continental could make it. end



Machine Team (although Special) Processes Varied Designs

by William E. Hoffman
Managing Editor

MEDIUM-RUN MANUFACTURING can have the advantages of automatic production without the expense if ingenuity peculiar to special-machine-tool builders is brought into play.

Recently, a tractor manufacturer replaced a large number of general-purpose machine tools with seven way-type machines designed and built by The Cross Company, Detroit, Mich. Production of tractor heavy cast-iron clutch housings is now less time-consuming, more flexible, and more accurate.

These new machines were introduced because clutch-housing design had become complex (they are now produced in six designs from two lengths of castings). When the general-purpose machines were used the parts were comparatively simple. Now they can no longer compete with multiple-spindle two and three-way machines. The seven new machines — each with a total cycle time of about three minutes — are operated with one man/two machines.

Machines operating on the same faces are installed across the aisle

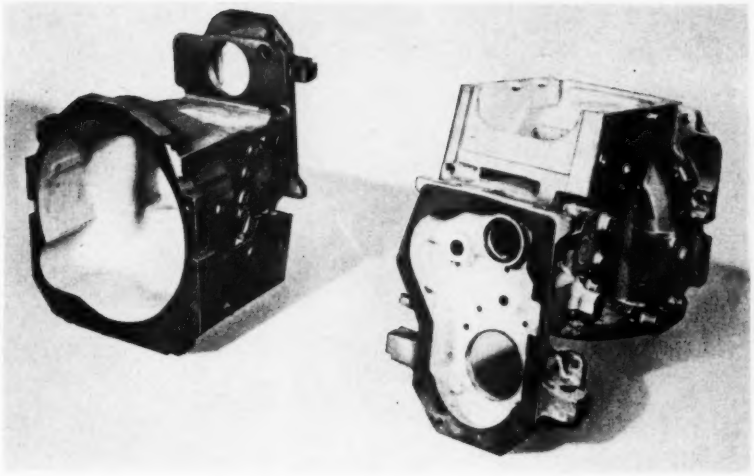


Fig. 1. Multiplicity of holes in a clutch housing can be seen in these two parts. The housing on the right shows the engine-mounting face. The other one shows the transmission-mounting face.

from each other and workpieces follow a zig-zag course through the line. Three housing designs go through six machines, while three others are required to pass through all seven machines. Sufficient space is provided between machines for banking partially finished parts when some machines are down for tool change.

Due to the proximity of holes on the faces of various workpieces, two 3-way drilling machines are used on the left side, the rear face, and front face. Two other 3-way machines drill holes in the left side, the right side, and the top.

One 2-way machine rough bores openings from the front and rear faces, and other similar machines finish them.

The seventh machine drills and bores the top, the right side and the left side of selected parts.

Individual machines can be quickly set up to handle the two lengths of castings for the various holes and hole-patterns of the six housing designs. Standard slip-spindle heads are used on drilling machines so correct drills can easily be positioned for each part. Operators set up each machine with a check list so incorrect spindles and drills cannot be used. The bushing plates on heads are ad-

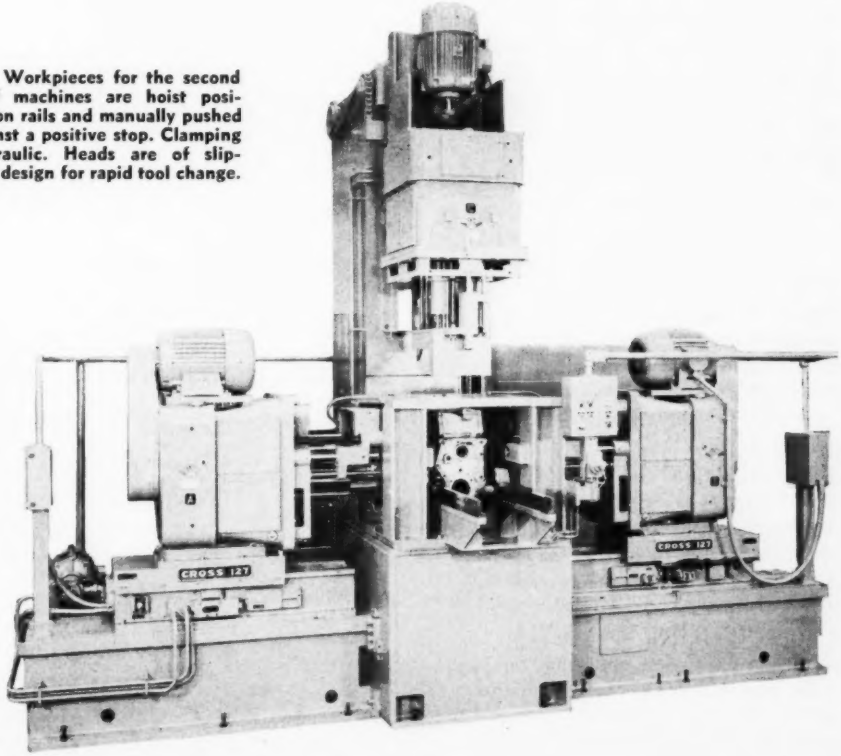


Fig. 2. Workpieces for the second pair of machines are hoist positioned on rails and manually pushed in against a positive stop. Clamping is hydraulic. Heads are of slip-spindle design for rapid tool change.

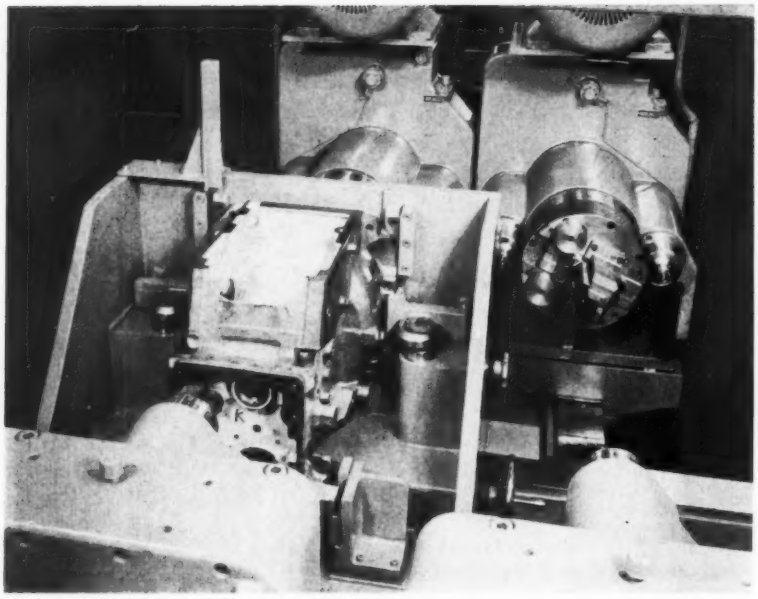


Fig. 3. In the rough and finish boring machines the large hole is machined and a generating tool faces an internal surface. Two dowel holes are bored at the same time with retractable spindles.

justable, where necessary, to compensate for different length castings and so future product changes can easily be accommodated.

The two boring machines have been designed for production flexibility; each machine has two pairs of heads and a shuttle-mounted fixture. All roughing operations for either length casting are done in one machine and all finishing operations are done in the other. Operations for one length casting are handled in the front shuttle position and those on the other casting are done in the back shuttle position.

If for some reason the production department should want to rough and finish long castings in one machine, and use the other machine for short castings, this can easily be done since any head can be used in any position on either machine.

The center spindle of the right-hand head (in both machines) bores a large internal hole. Then a generating tool faces an internal surface at the end of the feed stroke — boring tools retract so they do not run idle in the holes during the facing operations.

A complete cost and time analysis has not been made to compare present production methods with those formerly used. However it has been estimated that the seven-machine-team can do the job in one-quarter the time required for doing the job on standard machines. In addition to this, product accuracy is considerably better since hole relationships are established in the same machine in one setup.

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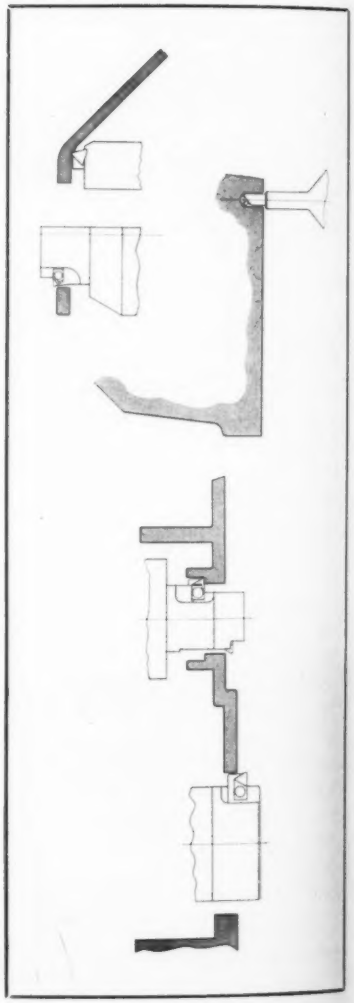


Fig. 4. Standard throw-away carbide inserts are shown in this drawing of typical tooling for two of the boring operations.

Tool Steel Castings

. . . use them to

Decrease Die Cost
Increase Die life

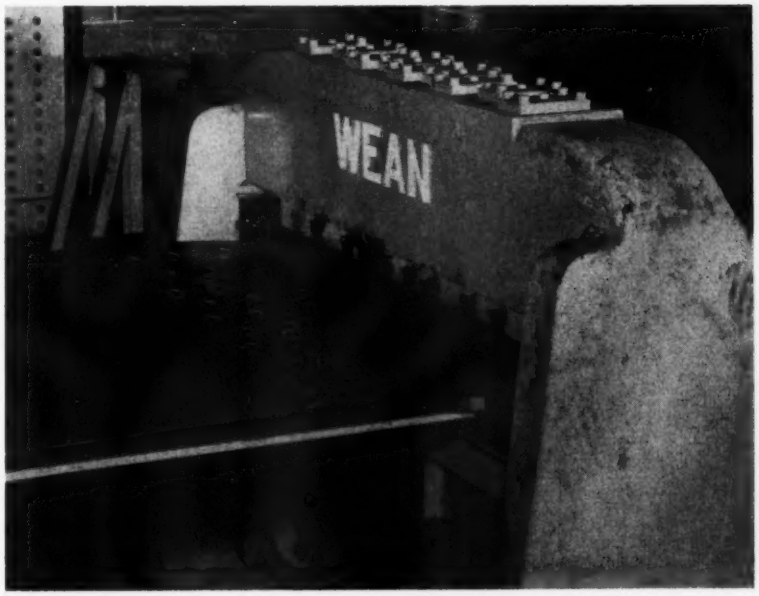


Fig. 1. Here stitches are leaving a Wean stitcher.

TO JOIN STRIP STEEL for continuous pickling, welding is universally used in the newer high production lines. However, stitchers are still used where the capital outlay is a concern and where production is low — or, as a supplement to a welder. Supplemental use is the more common. In this instance, it can be used as an emergency joining device if the welder breaks down.

The value of an emergency joining system becomes apparent when you consider the importance of the pickling line to production. Downtime here affects cold reduction, annealing, tempering, galvanizing, tinning, shearing, and all subsequent operations. The insurance value of having a second method available is often reflected in final production figures.

Where welding and stitching are both available one can "lean" on the other to keep the line running, but if stitching alone is used, the longest die life possible becomes most important.

In the stitching operation, a row or rows of U-shaped tabs are lanced simultaneously in the two overlapping strips. This is rough duty and the selection of die steel is important. By using Mineor, a 5% chromium medium-alloy steel, supplied by Darwin & Milner, Cleveland, die life is increased.

In this case, die life has been increased from three or four months to a year or more. Formerly a nickel-chromium low-alloy steel was used, whose composition was 0.65-0.75% carbon, 0.55-0.85 manganese, 0.20-0.40 silicon, 1.25-

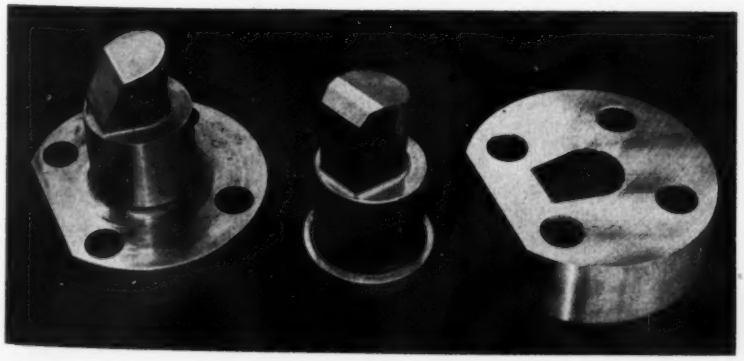


Fig. 2. Stitcher dies made of cast Mineor. Because they are cast machining costs are less than when machined from bar stock.

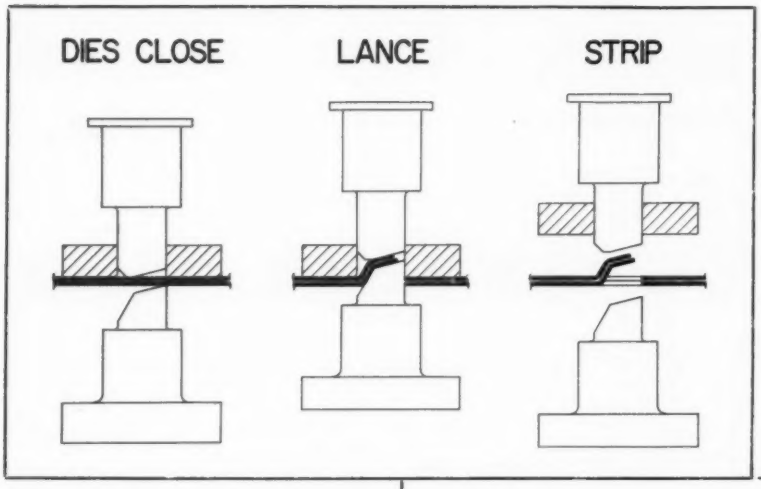


Fig. 3. The three steps in stitching.

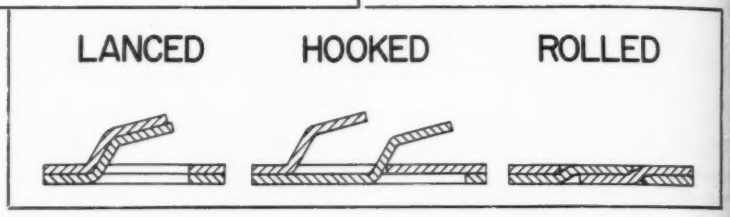


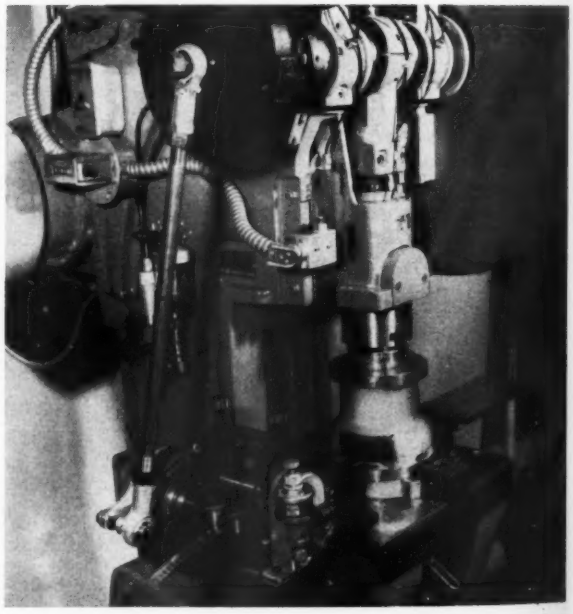
Fig. 4. Section showing tabs lanced, hooked, and flattened by rolling.

1.75 nickel, and 0.65-0.85 chromium. Its non-deforming properties, toughness, and wear resistance are only fair. Mineor, an air-hardening steel consisting of 1.00% carbon, 0.40 silicon, 0.50-0.60 manganese, 5.00 chromium, 1.00 molybdenum, and 0.25 vanadium, has very high nondeforming properties with fair toughness and good wear resistance.

Along with increasing die life, S&Z Tool & Die of Cleveland is able to use Mineor more economically because it can be supplied cast-to-shape. Dies that were previously machined from bar stock now only require finish machining.

—William J. Linhart

Safe Setup Of Standard Press



A West Coast manufacturer of precision thin-gage stampings protects carbide dies with the automatic safety features of a Kenco 15-ton Electro-Safe punch press.

In order to blank burr-less stampings in material as thin as 0.001", die closure tolerances are restricted to "zero clearance." Formerly, this required heavy die construction for necessary guidance, and die capacity of 25-ton straight side presses, representing approximately $17,000 in equipment and dies.

With the ample shut-height provisions of the Electro-Safe press and its positive safety features, many of these stampings are now produced in much less expensive "sub-press" dies with a $3,000 press. Stampings are produced at 350 spm in the press, with positive insurance of damage to expensive dies by strategically placed fault detectors that stop the press in one-third of a stroke should malfunctions develop.

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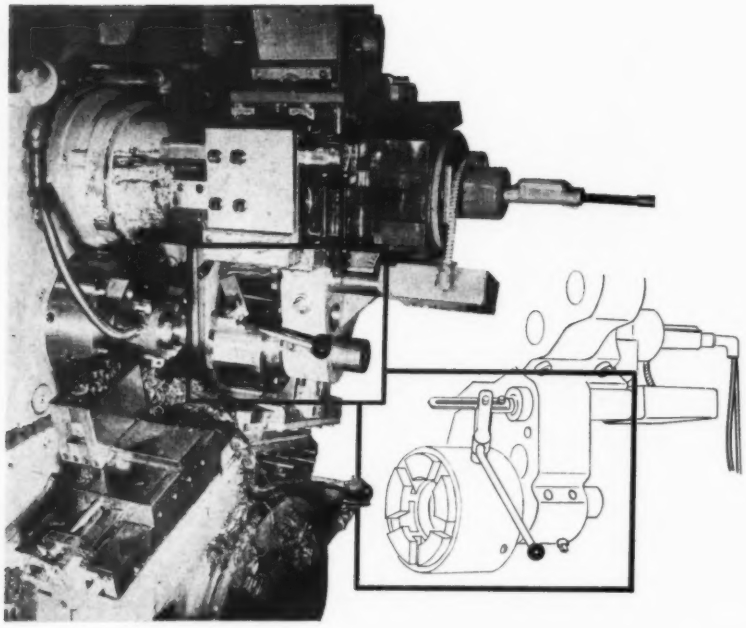

Fig. 1. Die release on Warner & Swasey 2AC quickly opens die when short thread is completed.

Die Release Solves Threading Problem

A tough threading problem has led to the development of a special electrically operated die release at U. S. Automatic Co., Amherst, Ohio. They use a Warner & Swasey 2AC chucking automatic to produce air cylinder heads which require accuracy, concentricity, and good finish.

On some of the heads, short threads of 1½ to 2 turns must be cut very close to a shoulder. Standard self-opening die heads did not operate well under these conditions and the die release device was developed. It has worked so well and proved so easy to operate that they use it on threads which could be handled by a standard die head as well as on the problem jobs.

The device (Fig. 1) is essentially a solenoid operated linkage which snaps open the die head at a point determined by the location of the special dog on the machine's "bird cage" (Fig. 2). The dog actuates a micro-switch mounted on a special bracket at the end of the speed and feed control arm. A micrometer adjustment of the micro-switch is provided and the company says that they can easily control the point of die head opening within 0.001″. This special opener assures that even a very short thread can be cut cleanly to a predetermined distance with no risk of back pressure on the threads or other distortion.

The threading job is one of a series of secondary operations done on the 2AC. Total time for these operations on the cylinder rod head is 3.12 min/pc. Included is turning of the thread dia at 380 sfpm, grooving and facing at 280 sfpm, turning the thread dia and pilot dia at 300 sfpm, and rough counterboring at 300 sfpm. The feed for each of these operations is 0.077″.

Other operations are finish counterbore at 300 sfpm and 0.003″ feed, face at 500 sfpm and 0.0019″ feed, finish groove at 250 sfpm and 0.077″ feed, and thread at 50 sfpm and 0.050″ feed using the electrical die release. end

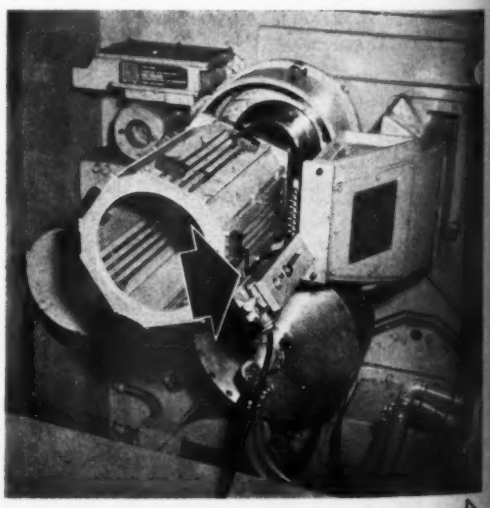

Fig. 2. Micro-switch (arrow) to control die release is mounted on bracket and actuated by special dog on drum at rear of machine.

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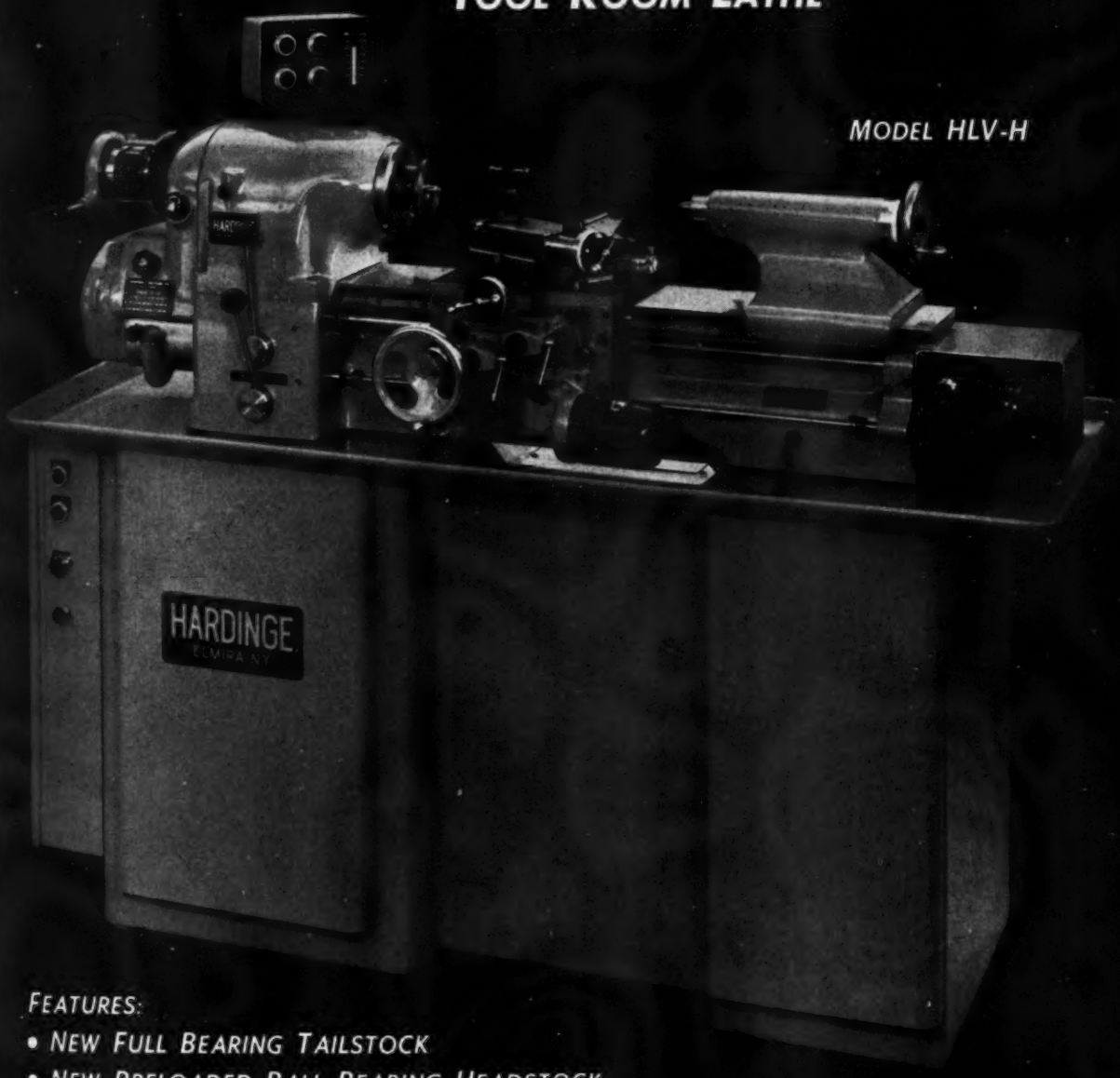

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Harder by nature than steel . . . next to a diamond in hardness, yet far tougher . . . Chromium Carbide Gage Blocks withstand rougher use, eliminate costly dimensional errors, and cut frequency of calibration and replacement. They have a thermal coefficient of expansion similar to steel. Fingerprints are not harmful.

Lightweight, non-oxidizing, possessing superior "wringability" and a stable, fine grain structure that takes and holds a mirror-smooth gaging surface . . . CARMET Chromium Carbide in gage blocks is leading the way to rigid new standards of dimensional control.

Carmet doesn't make gage blocks, but furnishes the chrome carbide to the progressive manufacturers who do.

A precise blend of extremely hard, finely divided carbides of chromium with a nickel binder, CARMET Chromium Carbide assures predictable, consistent behavior and unmatched uniformity from piece to piece.

These same unique characteristics make CARMET Chromium Carbide an important material for extrusion dies, valve seats, sealing rings, chemical processing equipment . . . or any other application where resistance to oxidation, corrosion, abrasion, erosion or chemical attack may be involved. For more information, contact your local Allegheny Ludlum CARMET representative, or write: ***Allegheny Ludlum Steel Corporation, Carmet Division, Ferndale, Detroit 20, Michigan.***

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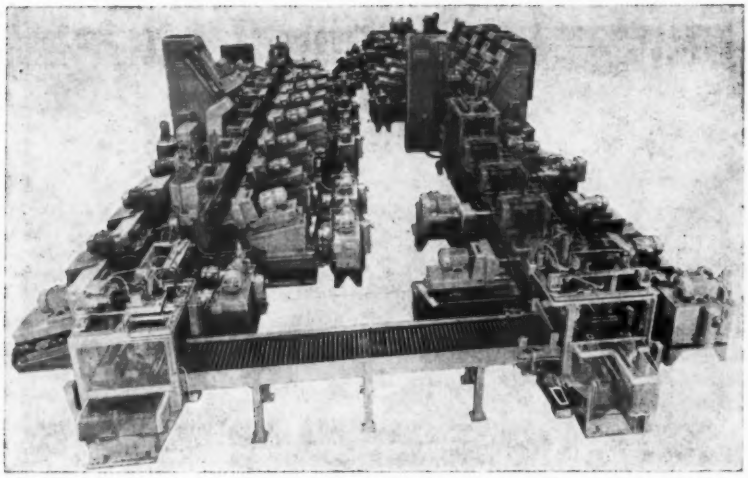

Fig. 1 — Over-all view of the "Economatic." The term applies to both the machine's production rate and easy-to-maintain floor arrangement.

Buhr's 'Baby' is a Big One

A HUGE "ECONOMATIC" lift and carry transfer machine that does 323 operations on auto cylinder heads has been delivered to American Motors Corp. by Buhr Machine Tool Co., Ann Arbor, Mich. The builder dubbed it "Buhr's Baby."

The 58-station giant performs these steps in automatic sequence on the 6-cylinder heads: rough and finish machining, probing, sealer application, assembling, pressure testing, rejecting and injecting. At 100% efficiency, it turns out 120 pcs/hr, as the work cycle is 30 seconds.

It's the first major piece of equipment built to the new Building Block Machine Tool Standards recently arrived at by users and builders of multiple-operation machine tools. It weighs 225 tons.

In its progress through the machine, a cylinder head is rotated through 90° twice, and tipped 90° four different times to present appropriate faces to the tooling.

The cylinder head travels 220 linear feet in its 30-second race through the Economatic. In that time, cutting, probing, and injecting tooling driven by a total of 520-hp is brought to bear on the part.

Design innovations, not covered by the new standards, have been incorporated into the machine. Among them is a new hydraulically-operated way type feed unit which is actually a compact power package with all controls panel-mounted on the side of the unit. This feed system provides a 60% increase in rapid traverse rate, and a 50% boost in structural strength over earlier feed mechanisms. A differential circuit reduces oil consumption 50%, permitting the use of smaller volume pumps.

The 58 stations are spaced over a 100 ft length, allowing easy access to any block for maintenance. The big machine occupies a 4000 sq ft floor area. end

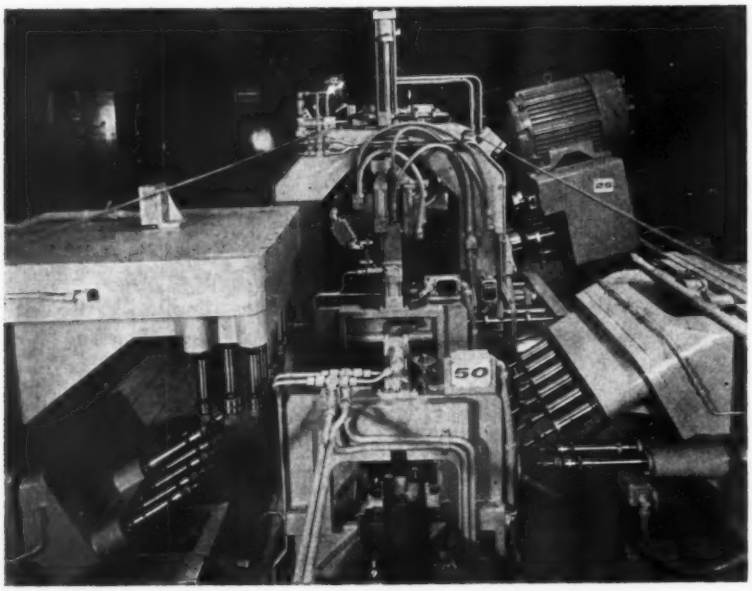

Fig. 2 — Typical of the "ganged" tooling in the machine are these tapping heads at Station 50.

9 surfaces rough and finish machined in 2 passes...

HOW MICROBORE CLUSTER TOOLING DOES IT ON A PRECISION BORING MACHINE!

Special Microbore Cluster Tooling makes it possible for a leading electrical equipment manufacturer to obtain a continuous flow of finished parts by rough and finish machining, simultaneously, nine surfaces on a generator end bell casting in two passes.

SET-UP TIME IS FASTER, TOO—Independent, precision adjustment of each tool point permits accurate settings in a matter of seconds. Speed and accuracy of adjustment, plus compactness of Microbore units, makes cluster tooling practical to a degree formerly considered impossible.

Microbore is a versatile tool with unlimited application for all types of boring, turning and facing operations. Microbore Standard Boring Bars, Boring Bar Sets and Flash-Change tooling complete the perfect combination for accurate, quick change tooling.

To find out how Microbore can help you, write for our new catalog No. 58.

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CIRCLE INFORM-A-GRAM KEY NO. 69

"Modern" Tricks For Progressive Die Building Give

Maximum Precision At Minimum Cost

by Carl Christen

Mr. Christen is Applications Engineer at The Foote-Burt Company, Cleveland, Ohio.

"Many a craftsman who kept secret his jealously guarded skill has passed on, leaving his successors to re-discover, again and again, that knowledge, which, if shared, would have benefited all mankind immeasurably. Let this not happen here." — Xenocrates

AT MODERN TOOL AND DIE COMPANY, Cleveland, Ohio, skill and ingenuity in die practice are precious assets to be shared and taught for the benefit of all. Modern is one of the largest die shops in this part of the country. They specialize in large auto dies production tooling for consumer products, and progressive dies for making smaller parts in large quantities.

Steve Molnar, superintendent of machine operators at Modern, has built up a 100-man die shop by admitting four to six apprentices a year to their 8000-hr training program in diemaking. "When you train your men in your own plant," says Mr. Molnar, "they know your needs as well as you do yourself. Sometimes better. I can't tell you how much time and money this saves in the long run." Mr. Molnar backs up his philosophy of sharing knowledge through numerous articles he has written on tool and die making. These are based not only on his ten years of experience at Modern Tool and Die, but also on his earlier background with one of the General Motors plants, where he was in charge of the toolroom and die shop.

Progressive dies are one of Modern's important products. The automotive industry depends on these long-run, high-speed dies to produce the myriad "little parts" that go into today's autos and trucks. Stamped clips, brackets, and fixtures, like those in Figure 1, are ordered by the millions and

. . . **continued on page 72**

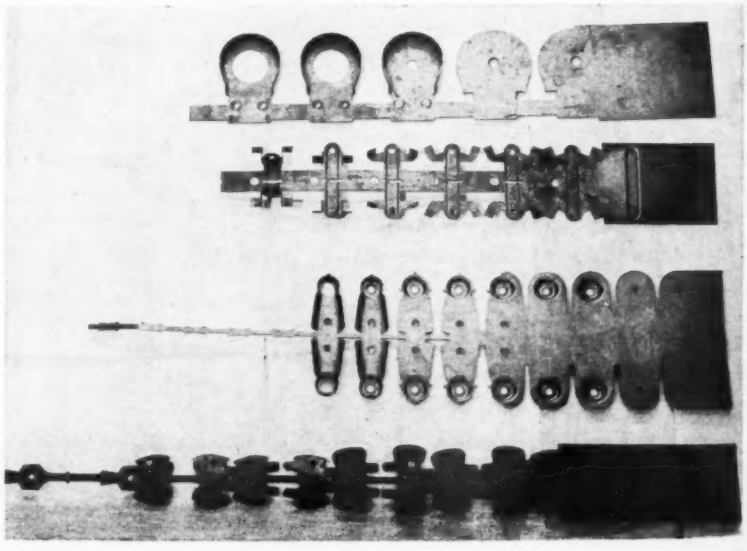

Fig. 1. Development strips representative of the progressive dies built by Modern Tool and Die Company. Press production of such pieces may run into the ten millions. Hence the need for dies of long life and economical maintenance.

JONES & LAMSON MACHINE COMPANY

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If you don't buy now . . . You'll pay later

You can bank on it. If you don't buy new production equipment now, you *surely* will pay later, and the price will be high in more ways than one.

The recent Machine Tool Exposition in Chicago demonstrated beyond a doubt that production economics *and* production techniques are undergoing rapid and sweeping changes.

As a result, production management is faced by two big jobs, 1.) Deciding *which* items of new, advanced equipment are best suited to individual plant requirements, and 2.) convincing top management that this new equipment *must* be acquired, and that it can be paid for easily in a way best suited to your needs.

Jones & Lamson can help you with this twofold problem. First, the new J&L line of machines is broad in application over a great variety of operations. Second, these machines will pay for themselves out of Profitivity®, and can be leased at an hourly rate of $2.50 per $20,000 of machine value: There's no advance payment, and the hourly rate drops to 12½¢ after five years.

Literature telling about the machines, how to justify their purchase, and how to pay for them, is yours for the asking.

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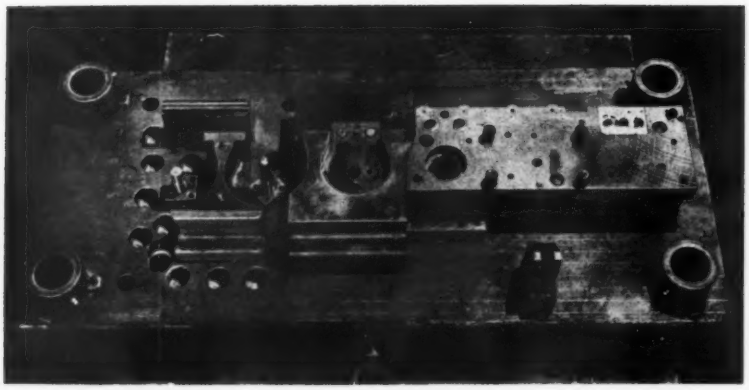
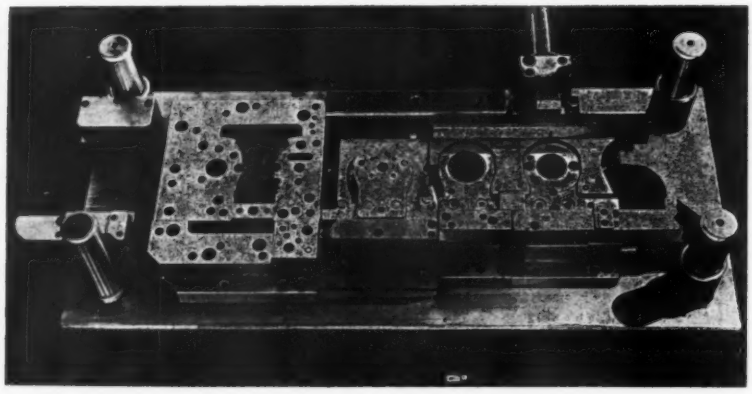


Fig. 2. Much trial and error was eliminated by making the forming stage of this progressive die first. Then a trial blank with a pattern of cross-hatch lines was formed. Thus the flow or behavior of the metal during forming was disclosed and enabled the diemaker to design the correct contour for the blanking stage punch. See upper strip, Figure 1.



. . . Maximum Precision, from page 70

ten millions. Were it not for progressive dies, these could not be made practically or economically.

Modern Tool and Die, makers of a wide line of lawn mowers, wheelbarrows, and other light-duty agricultural equipment at their Willard, Ohio, plant, also depends on progressive dies for many parts. So they have a personal interest in cutting diemaking costs wherever this will not sacrifice quality. Over the years, Modern's skilled diemakers have come up with a number of very economical techniques for progressive die building, at the same time improving precision and quality. Some of the techniques they use are described here.

Economy From Labor Management

Modern's first step toward cost reduction is their distribution of labor. First, engineers analyze the part drawings or sample parts, and design the over-all layout of a progressive die that will do the job. This layout contains principal die dimensions — but not detail dimensions or tolerances, which are left up to the man who makes the die. The layout then goes to a diemaker, together with a part print and pre-cut blanks of tool steel. After carefully studying the prints he makes the machining layouts on the steel and assigns the rough machining and grinding operations to various die-shop machinists.

He also specifies the heat treatment for each part, indicating how close to finish size it must be after heat treatment. While the dies are being machined and hardened the diemaker prepares precision templates for use during finish grinding of the die parts. Since many specialists work on the die at once, it gets done sooner, and less skilled operations do not tie up the expensive time of the master diemaker.

The die parts return from heat treatment to the diemaker, who checks them out to assure they meet his quality standards. Then he assigns the finish grinding to be done on one or more of the 12 grinding machines available. Very often, for dies which require particular care, the diemaker grinds the part himself on one of two Footburt-Hammond grinders kept especially for ultra precision finish-grinding operations. When necessary, he touches up and polishes the die parts with a hand grinder. Finally, the diemaker supervises the assembly of die parts, and checks the die out. When necessary, die parts are reground to achieve perfect assembly and the tolerances needed on the part.

Economy From Die Construction

Modern Tool and Die diemakers circumvent a great deal of trial and error in designing an irregular-shaped blank by making the forming stage of a progressive die first. A trial blank is first scribed with cross-hatch lines and formed in the die, Figure 2, or a prototype forming die. Using the cross-hatching as a guide, the diemaker develops the proper blank shape, and then makes the blank-and-pierce stages of the die. Next, he locates holes for guiding pins in the entire progressive die, using gage blocks and indicators to locate for rough drilling, and a jig borer for finishing the holes. This assures accurate pin location to 0.001″ or less. When blanking and forming stages have been completed and checked out, the other stages are designed, one by one, using the pins and holes at each stage as location points.

Alternate Methods

Two methods are used for making blanking dies at Modern: one for ultimate product precision, the other for maximum diemaking economy. As is well known, precision finishing of an irregular blanking die-hole is more time-consuming than precision finishing of the punch for that hole, since the die requires internal

. . . continued on page 74

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Completely automatic turret lathe gives peak production efficiency

J & L's new, completely automatic turret lathe sets a new high standard of efficiency for both bar and chuck work. Now, for the first time, you have the versatility of turret lathe tooling combined with completely automatic operation. All machine functions and sequences are pre-selected and programmed by the operator or set-up man, from a staging panel during initial set-up.

The automatic machine characteristics of this new lathe include fast motion, variable speed selection, spindle speed selection, turret indexing, coolant on and off, bar feed, and cycle stop.

A noteworthy feature is the automatic operation of a 12-speed hydraulic clutch headstock combined with a 24″ saddle motion which is actuated by a closed-loop, two-stage hydraulic servo system.

The cross slide has a 14½″ stroke and drive similar to that of the saddle, and has several automatic cycles, as programmed from the staging panel. Three speed ranges are available: 20 to 1000; 30 to 1500; and 40 to 2000 RPM. Power is from a single speed motor (up to 40 HP). Feed range is from .750″ per minute to 30″ per minute for the saddle, and from .375″ per minute to 15″ per minute for the cross slide.

Send now for our folder on this remarkable new machine. Jones & Lamson Machine Company, 519 Clinton Street, Springfield, Vt.

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. . . Maximum Precision, from page 72

grinding operations, and much handwork, while the punch can often be precision ground easily on a surface grinder.

For economy, the diemaker makes his punch first, sometimes leaving only 0.001″ to 0.002″ grinding stock. While the punch is being heat treated, he roughs out the soft die block to within about 0.030″ to 0.060″ of finish size. When the hardened punch returns, he grinds it to the correct dimensions, and uses it to impress the hole configuration on the soft die block. After excess material is removed, he uses the punch to shave the hole to size. Next, he hardens the die, which shrinks the hole slightly, and grinds it to fit the punch.

But for utmost precision, the diemaker generates the die hole first, leaving several thousandths of an inch for clean-up after heat treatment. While the die is being hardened, he roughs out the punch. When the die returns, he grinds it to the finish size and shaves the punch to size. The punch is next sent to heat treatment, (which enlarges it slightly) then it is ground to mate.

These alternate procedures differ in grinding time required on the die: when the die is shaved to size before heat treatment, only 0.002″ to 0.005″ of metal needs to be removed by grinding, while in the more common procedure (making the die first), as much as 0.020″ may be required for grinding stock.

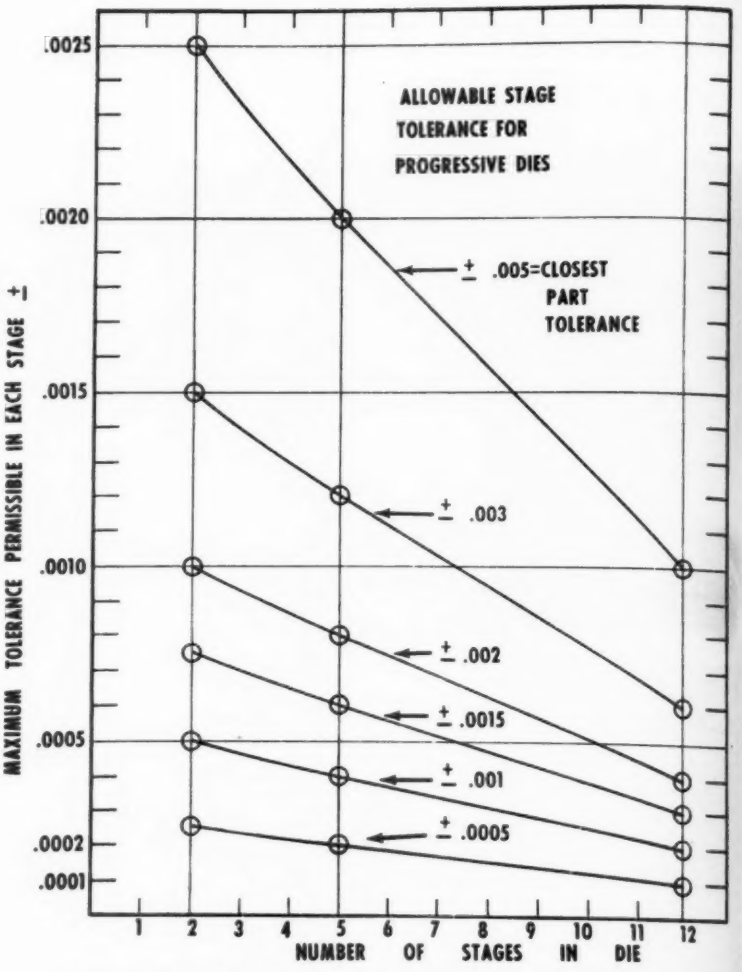

Fig. 3. Showing how progressive die "stage tolerance" varies with number of stages, for six different "closest part tolerances."

Economy From Tool Steel Selection

Modern Tool and Die keeps quality up and cost down by using air hardening tool steel which needs a minimum of grinding to clean up after heat treatment. For medium-run progressive dies (under 100,000 parts), most tool steel suppliers would recommend an oil hardening steel. But during heat treatment, oil hardening steel changes size more than air hardening steel. Experience has taught Modern's diemakers that oil hardening steels need 0.015″ to 0.020″ of stock allowance for grinding, while air hardening steels need only 0.005″ to 0.007″ stock allowance. In a progressive die, a relatively small amount of steel is used — and steel costs are only a fraction of the total cost. Finish grinding, however, accounts for a large part of the diemaking time (and cost) since the master diemaker usually must do this job himself. With less than half the stock to be removed from air hardening steel, die grinding time is cut in half.

But die cost is not the only basis for selecting steel. Modern uses oil hardening steel for the longest runs, rather than air hardening steel. Die failure by chipping is more common than failure by wear. And, for long runs, the user wants a die that can be repaired at low cost. When air hardening steel chips, extensive rework is usually needed, and often the die must be removed from service for grinding and heat treatment. This ties up production. Progressive dies made from oil hardening steel can be repaired by welding — sometimes without even removing the die from the press if grinding can be done with a hand grinder. Although initial die cost is higher because the oil hardening steel requires more grinding, this steel assures low maintenance cost during the life of the die.

Economy From Tolerance Selection

As a rule, the more stages in a progressive die, the tighter must be the tolerances in each stage in order to hold over-all tolerance. In theory, to hold 0.005″ toler-

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JONES & LAMSON
MACHINE TOOLS

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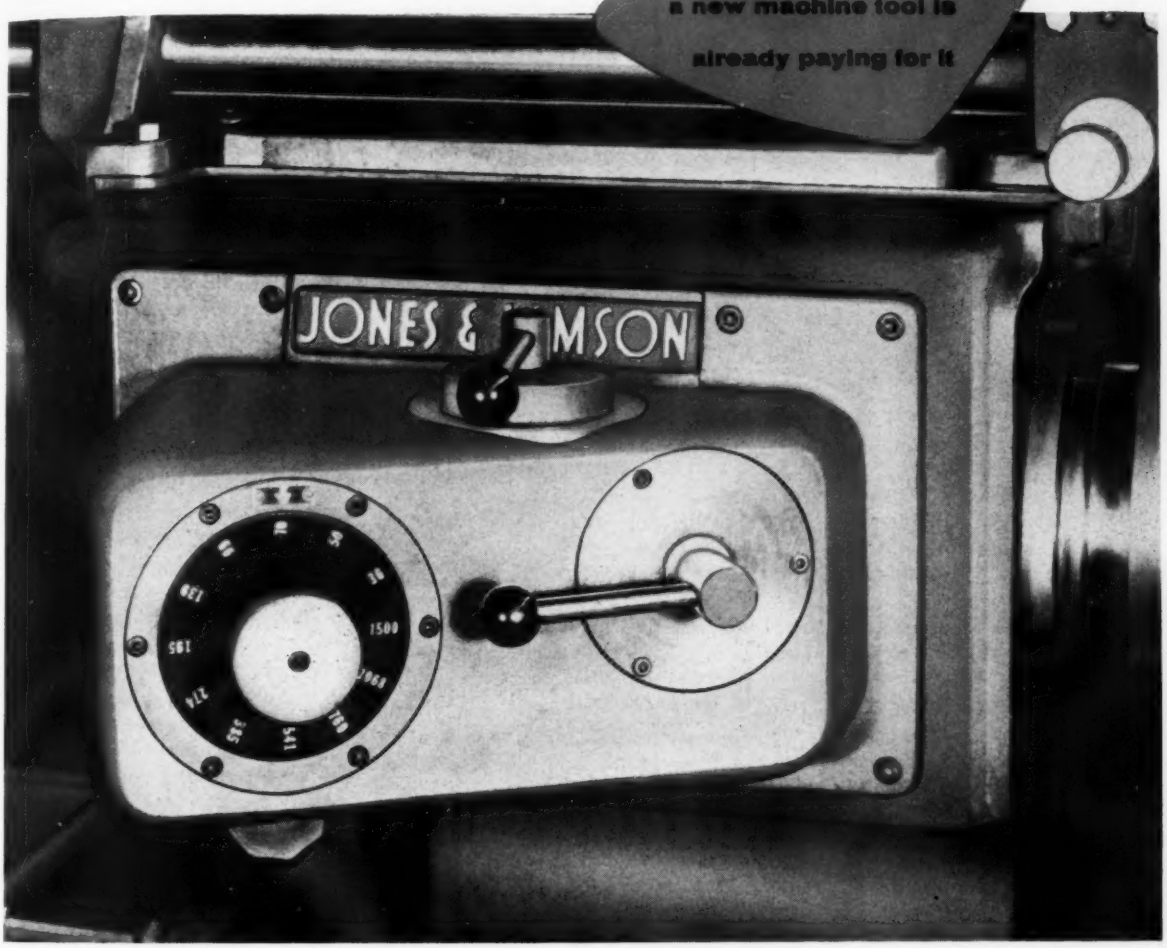

New improved design for J & L Ram and Saddle Type Turret Lathes

These two new J & L lathes are *really* new. No mere face lifting here . . . both lathes have been completely redesigned from the floor up!

Both the Ram type and Saddle type lathes are equipped with a multi-speed hydraulic headstock, and are capable of giving you more chips per tool, more pieces per hour, and more profit per job.

The redesign of these machines starts with 41″ of leg depth for more stable footing. New cross-ribbed bed design provides even greater rigidity for heavy cuts — and gives straight-line chip disposal out the back. The new wide pan includes a built-in accessible coolant tank at the head end of the machine. The new headstock transmits up to 40 HP.

An extremely important feature is the hydraulically operated clutches, which change pre-selected spindle speeds instantly and automatically.

Other features include: motor mounted vertically on the rear of the machine; a new carriage of rugged design, on which the stop spool is more conveniently located; heavy duty aprons which allow the adaptation of full length lead screw threading attachments, as well as the extremely versatile 2-Dimension (180°) carriage tracer; built-in independent pumps, which supply forced lubrication to the aprons, carriage, and saddle.

Both of these new lathes offer more power, greater accuracy, and easier operation. Write today for details. Jones & Lamson Machine Company, 519 Clinton Street, Springfield, Vt.

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CIRCLE INFORM-A-GRAM KEY NO. 75

Fig. 4. A skilled diemaker, in grinding a die segment, gets that "last kissing pass" to a fractional ten-thousandth in size by the feel and sound of a manual feed grinder.

. . . **Maximum Precision, from page 74**

ance on a part made by a two-stage die, each stage may have as much as 0.0025″ tolerance. But for a five-stage die, the tolerance in each stage tightens to 0.001″ or less, and for a ten-stage die, to 0.0005″. Die cost increases in geometric progression as tolerances get tighter, especially on die stages made up of 15 or 20 parts.

Taking a more realistic approach, if some stages have a small plus tolerance, and others a small minus tolerance, so that over-all deviation does not exceed the part tolerance, then the work of grinding to size in each stage will be kept to a minimum, scrap will be reduced, and grinding costs cut by 20 to 30%! Relatively broad tolerances can actually be permitted in each stage of a progressive die, as long as they supplement each other to maintain over-all tolerance.

Modern Tool and Die gives its diemakers "open tolerance" on each of the individual die segments. When assembled, however, the segments must form a complete die stage whose tolerance does not exceed a reasonable value for that stage. Thus, on the five-stage die of Figures 1 and 2, a broad allowance of 0.002″ may be permitted in each stage, and for a ten-stage die, 0.00125″. Holding the looser tolerance is easy, and the die can be completed at lower cost without sacrificing accuracy in the finished part.

To keep costs down even more, Modern's diemakers avoid grinding any unnecessary areas, unless grinding purely for appearance is demanded. All grinding is done dry, generally with vitreous-bonded aluminum-oxide wheels of grade G to J. Roughing wheels are 40 to 60 grit, finishing wheels 100 to 150 grit.

Economy From Grinding Techniques

Although most of the surface-grinding machines at Modern Tool and Die are used for both roughing and finishing work, two Footburt-Hammond grinders, Figure 4, are reserved for precision grinding on progressive die parts. To get that "last kissing pass" that finishes a die segment to a fractional ten-thousandth of an inch, some very special features must be built into the grinder itself. Table drive, for example, must be "smooth as silk," with height variations in table travel that do not exceed more than a few millionths of an inch. The Hammond grinder utilizes a chain drive for the table, and the table rides on hand-scraped ways. The spindle adjustment must be positive, especially during down-adjustment, when homing in on the last passes. To assure that the spindle does not "drop" during a pass, the spindle raising nut has a self-adjusting backlash eliminator to compensate for wear automatically. Although the spindle adjustment handwheel on the Hammond grinder has a vernier scale that reads accurately to 0.00005″, Modern's diemakers prefer grinding to size by "feel" and "sound" of the grinding action, which helps to achieve even greater accuracy.

When the last few thousandths inch of metal are ready for removal from a die segment, the diemaker begins to finish off all of the flat broad surfaces first, approaching finish dimensions as closely as possible. These surfaces serve as locating surfaces for the form grinding which follows. Parts are held in a vise, mounted on an angle plate, or held on a magnetic chuck. The diemaker next dresses his wheel to form with a diamond dresser, and grinds the irregular shapes or angles, bringing the die segment to finish size. To guarantee absolute precision, he makes sure to spark out the wheel completely on every finishing cut.

These techniques cut grinding costs in several ways: First, using a precision grinder exclusively for precision grinding assures that neither the machine spindle nor the die segment will be strained or distorted by heavy loads. Second, the light cuts remove metal without burning, avoiding catastrophic grinding cracks, and eliminating the effects of burning from heavy grinding. Finally, complete sparking out opens the wheel face. This prolongs wheel life, giving an absolutely flat, parallel ground surface with a low micro-inch finish. Diamond form dressing is used in preference to crush-roll dressing, since only one or two parts in each die have the same form, and this does not justify the expense of a precision forming roll. When precision has been attained by grinding, the diemaker puts a final polish on die segments by hand lapping.

Mr. Molnar attributes much of Modern's success to the ability to satisfy customers with the best quality dies at competitive cost.

end

JONES & LAMSON OPTICAL COMPARATORS

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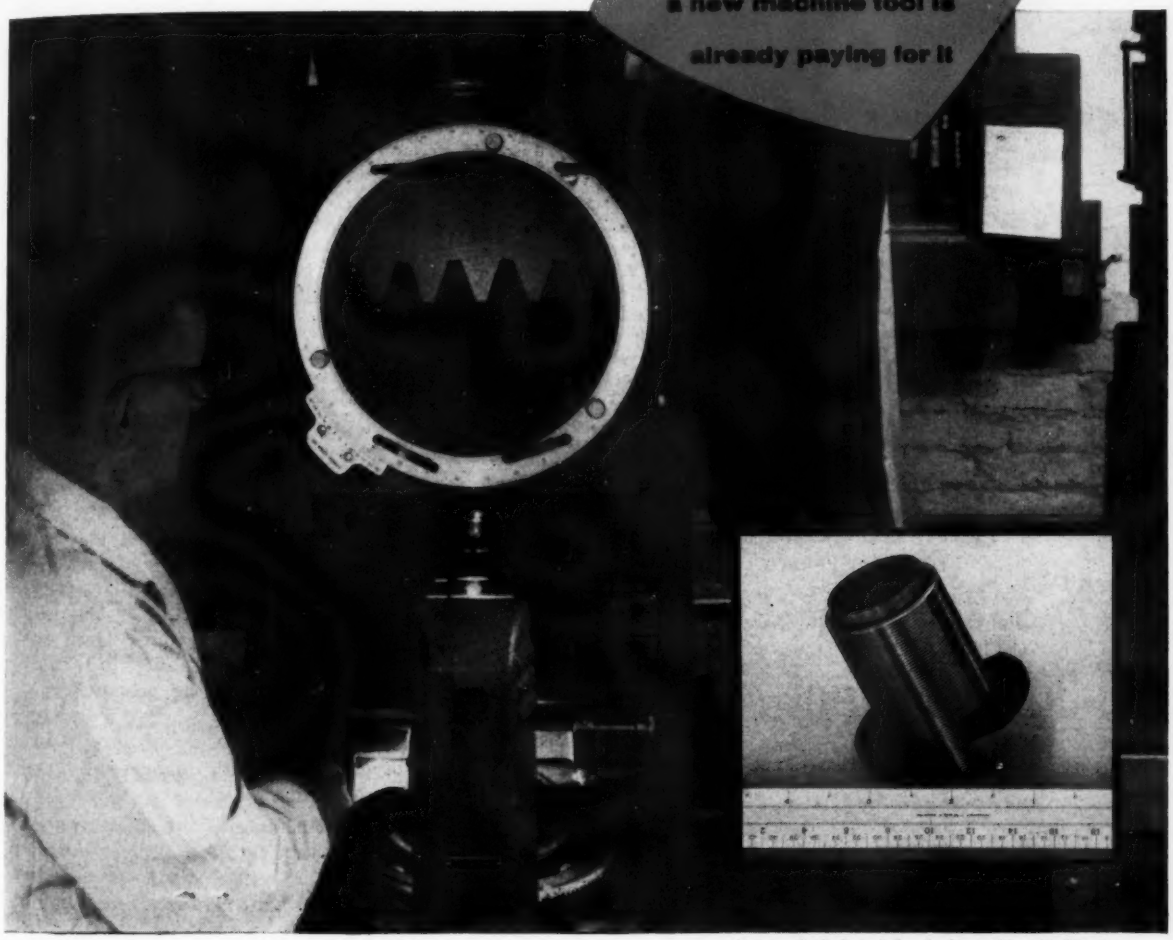

Unretouched photo (above) shows this cylindrical rack being inspected at 62.25X. Photo, courtesy of Baird-Atomic Inc., Cambridge, Mass.

4000% Increase in Inspection Efficiency through use of a J & L Optical Comparator

Baird-Atomic, Inc., Cambridge, Mass., manufacturer of scientific and research instruments needed a rapid and precise method for the quality control measurement and inspection of various components. After experimentation with various types of inspection equipment, a J & L FC–14 Optical Comparator was given a trial. It met all requirements perfectly.

The inspection of a cylindrical rack, heart of the Baird-Atomic Periscopic Sextant, used in advanced aircraft, gives an illustration of the J & L Comparator's efficiency.

The rigid quality control tolerances for this part include: tooth-to-tooth tolerance, .0002"; tooth-to-tooth error, .0003"; composite error, .0003"; pitch dia. within .0005"; concentricity within .0005" TIR.

Adequate inspection and measurement by conventional methods proved laborious and time-consuming: inspection rate was little better than one rack per day. Now, using a J & L FC–14 Optical Comparator, average inspection rate is 42 per day, an increase of approximately 4000%!

Investigate the possibilities of J & L Comparators in *your* production set-up. Available in 12 different models, both floor and table types.

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90% maintenance cut
75% savings in setup time
20-30% material cost reduction

And improved accuracy, strength, and appearance

THESE SUBSTANTIAL REDUCTIONS which came about in the manufacturing of loudspeaker conehousings are the result of carefully planning their new punch press and die modernization program.

The new stamping method and recently installed equipment have put Magnavox in an enviable position. In their highly competitive business a fraction of a cent can make the difference between getting or losing a contract.

Old Method

Their production could be classified as "job-lot-mass" since they have to juggle the production of various conehousings to harmonize with assembly schedules.

Previously parts were being stamped on seven straight-side presses using single stage dies. Parts were fed by hand — requiring seven men. Handling was from press to press by chute and belt conveyor. Not only that, but stock had to be sheared to proper strip width for hand feeding the first press.

In this manner they turned out an average of 625 finished parts/hr. Truly slow. They had to do something.

Process Analysis Before Decision

Members of the Industrial Engineering Department, under Mr. F. J. Henry - Chief Industrial Engineer, investigated all facets of cost. They followed Tool Engineer A. H. Oldham's various approaches to cost reduction and facility analysis, and it soon became apparent that extensive modification to existing equipment and/or procurement of new equipment would be required.

Industrial Engineering reviewed their preliminary findings with with production personnel, E. J. Walker - Toolroom and Fabrication Superintendent, and J. E. Holt - Plant Engineer, and a team was established to handle the many implications of the proposed project. Planning began drawing heavily on Walker's years of experience, Holt's "know-how" and Oldham's tooling knowledge.

In the interest of economy they first thought to use their existing dies by automating the seven presses with transfer devices to carry the parts at a higher rate. This would have required a new electrical control system in addition to expensive transfer mechanisms and installation changes. They decided this was not the answer and turned to consideration of a transfer press. This plan would also release existing presses for other production.

During exposure to the various available modern press production methods, Minster recommended the use of progressive dies in their 300-ton straight side press with automatic feed. Although Magnavox was skeptical of progressive dies for speaker housings, the prospect of a lower initial investment, longer die life, and other economies were attractive. Also, by the use of

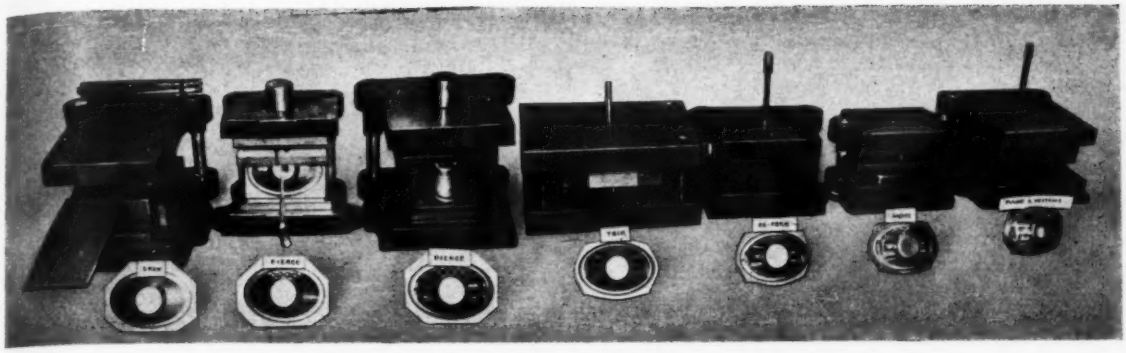


Fig. 1. Old tooling for primary and secondary operations on conehousing consisted of from five to seven separate dies for each size. Part accuracy was difficult and costly to maintain, and setup time was high.

new equipment, production could proceed without shutting down.

Interested, they studied the proposal from the standpoint of product design, tooling, available floor space, condition of existing dies, production scheduling, maintenance and material handling. Their decision was finally made in favor of a recently developed Minster "Progress-O-Matic," a two-point straight side automatic production press.

This 300-ton press is double geared, with opposed helical drive, equipped with an intermediate shaft combination air friction clutch and brake drive arrangement. This makes it possible to attain an exceptional speed range for a double geared press — 25 to 50 spm. For drawing, a twin geared press was a must to reduce crankshaft torsion and give greater capacity above the bottom of the stroke. Variable speed range was also a requisite to meet various part requirements.

Also they had the foresight to select a size larger press than their immediate needs (48″ x 84″ bed). With a larger press they could expect greater precision due to minimum deflection, and future expansion is always to be considered.

Proposal to Management

With the best procedure decided upon Henry, and J. P. Higgins - Process Engineer, prepared a comprehensive proposal for management. One of the most favorable points of interest was the conservative estimate that the new equipment would pay for itself in less than two years.

With such assurance it was easy for W. C. Seward - Division General Manager, to approve the proposal and authorize proceeds for the entire plan, including related tooling.

Installation and Start Up Procedure

But teamwork was not over. During building and delivery each member had much to do to get ready for the changeover.

Holt spent several days at Minster familiarizing himself with the

Fig. 2. Conehousings were formerly hand fed into blanking-drawing press and transferred by chutes and conveyors to each of six secondary operation presses.

construction of the press for he had to know the assembly procedure, and make plans for installation. This paid off, for by careful pre-erection planning the regular maintenance crew with little outside assistance, completed the installation without interrupting their normal activities.

Oldham made good use of the press erection period to design and procure the necessary new dies, and their delivery was timed with that of the press and mill stock.

Walker assigned an experienced die setter to initial die tryout, and the same man ran production for 30 days prior to turning the machine over to a regular press operator.

Die setting was especially important since customer hole patterns vary as to shape, position, and the use of inserts. When changing from one part to another this had to be completely understood.

Fig. 3. In the old method, partially completed parts were hand fed into secondary operation presses, air-ejected to chutes and conveyors between presses.

After Five Months — a report

1) Average cost of stamped conehousings was cut in half (50% savings). This allowed a lower selling price, higher plant productivity and resulted in more work for the men.

2) Where **seven men** formerly produced 625 parts/hr, **one man** can produce 1800 parts/hr (84% labor savings). Interestingly enough this automation did not reduce labor requirements — but it did raise the level of plant employment.

3) Material Savings — 20% to 30%. The progressive operation allowed better use of material, and reduced scrap.

4) Maintenance of progressive dies as opposed to single stage dies was 90% less. Even after a run of 240,000 parts present dies did not need grinding.

5) Reduced die setup time 75%.

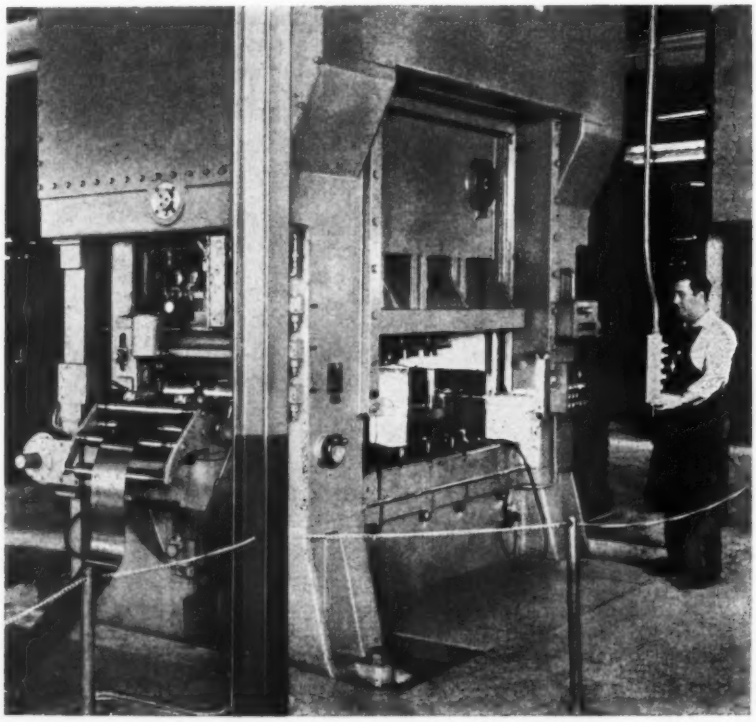


Fig. 4. New method uses one machine and one operator to produce 1800 pcs/hr.

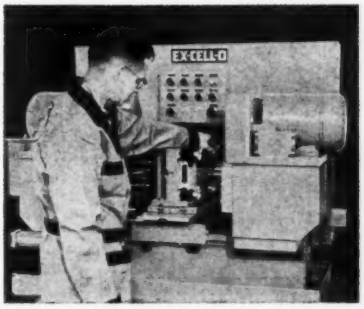
Fig. 5. Conehousings are now stamped out on seven stage progressive die and air-ejected to conveyor and tote box.

Since stamping operations are job-lot their runs are from 50,000 to 100,000 parts, and dies are changed frequently. Magnavox now needs only 25% of the former setup time. Productive time is from 48 to 51 min/hr (based on a full week's production).

6) The precision of the press and tooling has greatly increased accuracy. Strength and appearance is also improved. This shows up dramatically in final assembly where rejects are practically unheard of and loudspeakers go together with ease.

Extra copies of this article are available while supply lasts. Write Tooling & Production Magazine, 1975 Lee Road, Cleveland 18.

22 Holes Bored In Two Steps

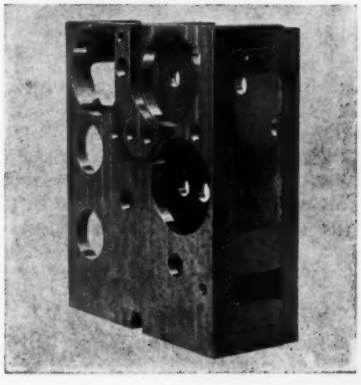


This precision boring machine is the smallest in the range produced by Ex-Cell-O Corp. It utilizes the latest multiple-spindle concept and in this application bores a total of 22 holes in a small aluminum gearbox frame assembly. Operation is achieved by the use of interchangeable plates carrying multiple spindles.

The five larger holes are bored at the first setup. Locating from established dowel holes and hand clamping the part in a simple fixture, tolerances on hole diameters are held to within 0.0005″.

The second operation involves boring from both sides. Here the original spindle plate is quickly detached and interchanged with a 7-spindle plate. A 10-spindle component is mounted at the other end of the machine. After one lot is rapidly bored, bronze bushings are assembled in the holes in the parts, tools are changed at the machine, and the operation is repeated.

The parts were formerly bored in a tool room setup, requiring a full day to complete one part. Now they are finished in minutes. Several precautions are taken to ensure consistent accuracy, one of which is holding the spindle plates to a constant temperature.



EVERY SECOND A TOOL STANDS IDLE WHILE AN OPERATOR LOADS OR UNLOADS COSTS YOU MONEY

Any one of these BELLOWS-VALVAIR Air-powered Work Feeders can cut that idle time in half!

Need close tolerance indexing?

Model BRET-13B
13" diameter top
Factory set for either 4, 6, 9, 12 or 18 stations

Model BRET-26C
26" diameter top
Factory set for either 4, 6, 9, 12 or 18 stations (may be ordered for a maximum of 36 stations)

Extremely close indexing tolerances . . . that is the extra feature built into this group of Bellows-Valvair Rotary Index Tables. Built to rigid standards of workmanship and material, they provide a quality of performance unmatched in their field. These units, too, have built-in controls to regulate the indexing speed; they are complete units, just make the necessary electrical and air supply connections; they may be easily synchronized with other Bellows-Valvair equipment to build completely automatic, high speed special purpose machines.

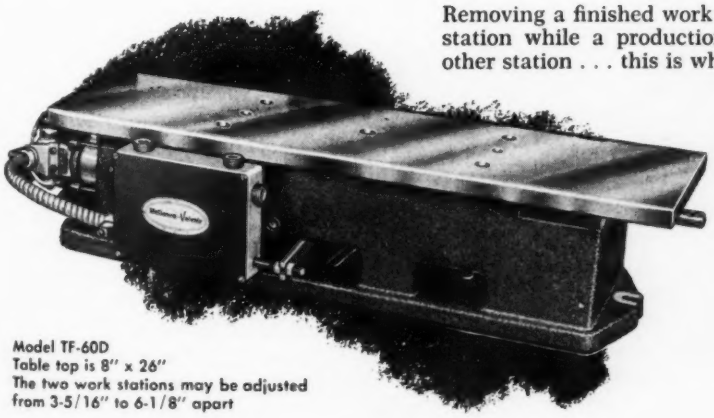
Need high speed work positioning?

Model BRET-10C
10" diameter top
Adjustable for 4, 6, 8, 12 or 24 stations

Model BRET-22C
22" diameter top
Factory set for either 4, 6, 9, 12, 18 or 36 stations (may be ordered for a maximum of 72 stations)

These Rotary Feed Tables position work pieces with high accuracy, at a rate to match machine efficiency. The units are complete; require only mounting, attaching electrical connections, coupling with air supply. They may be mounted in any position thereby allowing a wide range of application for feeding a variety of work pieces in very simple or complex machine or processing systems. Indexing speed is easily controlled . . . two speed control screws on the Electroaire Valve® may be adjusted to regulate the rotating speed of the table top. Oversize table tops may be attached to the standard top.

How about 2-position shuttle feeding?



Model TF-60D
Table top is 8" x 26"
The two work stations may be adjusted from 3-5/16" to 6-1/8" apart

Removing a finished work piece and positioning a raw part at one station while a production operation is being performed at the other station . . . this is what the Bellows-Valvair Shuttle Feed provides and, by doing so, unloading and loading time does not interrupt the machining operation. Speed of movement of the top is easily adjusted by the control screws built into the Electroaire Valve controlling the Bellows Air Motor®. The unit is complete when received, ready to install and operate. And, it may be synchronized with other Bellows-Valvair equipment . . . a feature of all Bellows-Valvair "Controlled-Air-Power" Packaged Units.

872C

Bellows-Valvair
AKRON 9, OHIO
DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

TP-1160

Bellows-Valvair, Division of IBEC, Akron 9, Ohio

Please send me full details on Bellows-Valvair Air-powered Index and Work Feeders.

Name _____

Company _____

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CIRCLE INFORM-A-GRAM KEY NO. 83

SAVE MACHINING

AMPCO® metal STOCK BARS are semi-finished all over

You take finish cuts only on Ampco metal centrifugally-cast bars. They are semi-finish machined all over—finish allowance, 1/16" on O.D. and I.D. You save time, cut costs.

Made of Ampco 18, a tough copper-base alloy that resists wear, shock, impact. Ideal for bearings, bushings, gears, and similar applications.

Your Ampco stocking distributor can supply 90 sizes up to 10" O.D. 12½" lengths. Call him for prompt delivery.

AMPCO®

PRODUCERS OF THE METAL WITHOUT AN EQUAL

D-726

AMPCO metal

AMPCO METAL, INC.
Dept. 54K, Milwaukee 46, Wis.
West Coast Div.: Huntington Park, Calif.
Southwest Div.: Garland (Dallas County), Texas

CIRCLE INFORM-A-GRAM KEY NO. 84

MEN YOU SHOULD KNOW

Earl E. Conlin has been elected vice president for finance, **Ex-Cell-O Corp.** Other changes include: **Miles H. Knowles,** secretary; **Edward J. Giblin,** treasurer, and **Russell D. Hughes,** controller.

U. S. Industries, Inc. named **I. John Billera** executive vice president-operations. He will be directly responsible for the operations of USI's thirteen divisions and subsidiaries. **Arnold P. Moran** has been elected vice president-treasurer.

Announcement has been made by **Latrobe Steel Co.** of the promotion of **John Wandrisco** to vice president in charge of corporate planning.

John W. Rayner was recently appointed administrative assistant to the president of **Clearing Div'n, U.S. Industries, Inc.,** and **Henry M. Crossen** has been appointed vice-president of manufacturing.

The new chairman of the board of directors of **E. W. Bliss Co.,** is **Robert Potter,** former president. **J. Ralph Patterson** has been elected president and chief executive officer. Mr. Patterson was also elected a director of the company.

Recently elected directors of **Adamas Carbide Corp.** were **Edgar P. Eaton, Jr.,** and **Frank M. Mansfield III.**

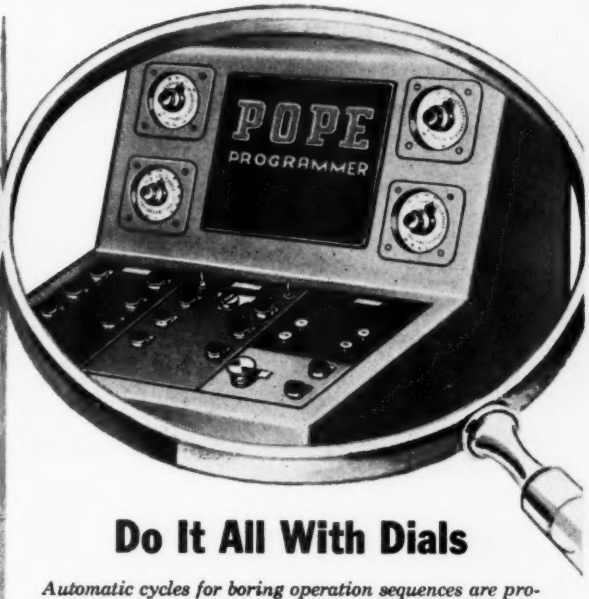
The Rotor Tool Co., a subsidiary of **Cooper-Bessemer Corp.** has made known the appointment of **Richard Allchin** to president; **L. W. Dwors** to vice president, manufacturing; **Hugh L. Whitehouse** to director of engineering and secretary-treasurer; and **Paul Van Sittert** to director of research.

Charles E. Peterson has been named Division manager in charge of the **Mackintosh-Hemphill Div'n of E. W. Bliss Co.**

Horace Frommelt has been appointed director of Manufacturing Research for **Ferro Powdered Metals, Inc.** Mr. Frommelt was formerly a director of the Spring Garden Institute - Metal Removal Center. He will accelerate Ferro's research programs, particularly in new applications for powdered metallurgical components.

YOU CAN INCREASE PROFIT AND PRODUCTION

with this new POPE 10-6 SUPER-PRECISION BORING MACHINE



Two Heads Are Better Than One

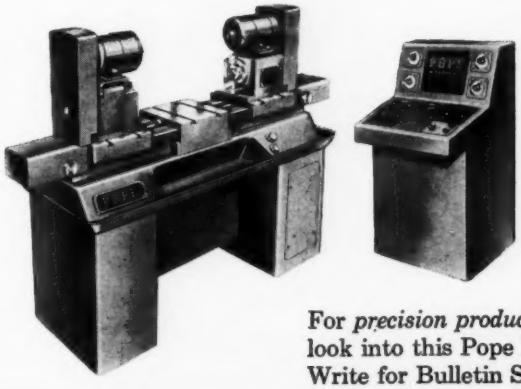
and of course you can have more than one spindle in each head. The Pope Model 10-6 features *two precision boring heads** operating completely independently of each other to provide simultaneous or alternate cycling movement of the heads. *This means increased production.*

*The Pope Boring Head Spindles on this machine revolve within 20 Millionths.

Do It All With Dials

Automatic cycles for boring operation sequences are programmed on these dials. The operator simply determines the sequence of operations and dials each one. You get continuous production of uniform parts in less time.

The Pope Electric Programmer gives you finger-tip fast control of infinitely variable speed, distance and operating sequence. You dial in the complete program with ease and speed that beats expensive numerical or tape control. Supreme accuracy is maintained for cycle after cycle.



For *precision production at a profit* look into this Pope Model 10-6. Write for Bulletin S-21.

No. 132

POPE®

ENGINEERS, DESIGNS AND BUILDS PRECISION ANTI-FRICTION BEARING SPINDLES FOR EVERY PURPOSE

POPE MACHINERY CORPORATION • 261 RIVER STREET • HAVERHILL, MASS.

Established 1920

CIRCLE INFORM-A-GRAM KEY NO. 85

In an executive realignment move at **Michigan Abrasive Co., W. S. Hoskin,** former general sales manager, has been named vice president in charge of sales. **Ken C. Davis,** former assistant general manager, has been made general sales manager.

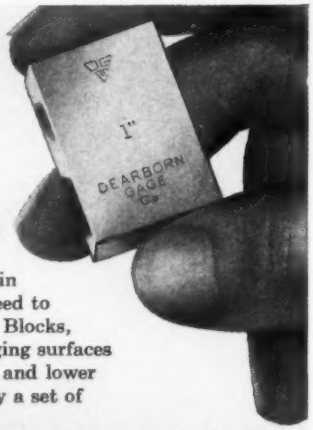
The Cleveland Cap Screw Co., a subsidiary of **Standard Pressed Steel Co.** has appointed **Herbert D. Burdick** general sales manager.

Vice president of marketing services for **Clearing Div'n of U.S. Industries, Inc.,** is **T. Singelis.** He will be responsible for Clearing's market research, sales analysis, order and customer service, and advertising and sales promotion.

In charge of **Mathews Conveyer Co.'s** engineering-sales office in Lexington, Mass. is **Alvin Wysocki.**

Longer wearing MILLIONTHS

Time you got acquainted with the world's first* and finest gage blocks. Blocks possessing correct temperature coefficient—absolute metallurgical stability. Blocks with a positive built-in wear factor—unconditionally guaranteed to be minus nothing from nominal size. Blocks, too, that feature chromium plated gaging surfaces to give you longer wearing millionths and lower gaging costs. Yes, it's time now to buy a set of



ELLSTROM CHROMIUM PLATED GAGE BLOCKS

MANUFACTURED AND CALIBRATED TO THE INTERNATIONAL INCH—EXACTLY EQUAL TO 25.4 MILLIMETERS

"W" Working Accuracy: +.000008"/−.000000"
Parallelism: .000004" / Flatness: .000004"
"I" Inspection Accuracy: +.000004"/−.000000"
Parallelism: .000003" / Flatness: .000003"
"L" Laboratory Accuracy: +.000002"/−.000000"
Parallelism: .000001" / Flatness: .000001"

Above: Ellstrom Rectangular Set No. 92-R. Right: Ellstrom Square Set No. 81-SA, with accessories.

New Catalog contains prices and specifications—send for it today!

ELLSTROM STANDARDS DIVISION DEARBORN GAGE COMPANY
22038 Beech Street Dearborn, Michigan
Originators of Chromium Plated Gage Blocks

*Ellstrom—*Measuring in millionths for three generations*

Hjalmar Ellstrom (1863-1942)—He gave mankind the key to mass production of interchangeable parts. For it was he alone who conceived and produced the world's first combination gage blocks—the first master reference standards accurate to the infinitesimal millionth part of an inch!

CIRCLE INFORM-A-GRAM KEY NO. 86

Don Morton has rejoined the **Morton Tool Co.** as sales manager.

Appointed sales engineer for **Bohn Aluminum & Brass Corp.** is **Gerald H. Dettman,** assigned to Chicago district.

Wiancko Engineering Co. has recently appointed **Rush S. Drake Associates** to represent their line of force and pressure measuring instruments in Oregon, Washington, Montana and Idaho.

Newly appointed vice president and general sales manager of **Walworth Co.** is **Hellmuth "Dick" Strauss,** replacing **Harold Brown** who resigned.

The **"POP" Rivet Div'n of United Shoe Machinery Corp.** has appointed **Charles F. Buehring** as its district representative for the South Pacific region.

A. N. Aiman has been appointed sales manager of **Parker Fittings & Hose Div'n of Parker-Hannifin Corporation.**

Sales engineer for **Wai-Met Alloys Co.** is now **Richard J. Dvorak.** He will handle sales and provide technical assistance on refractory materials, in addition to handling sales of specialized casting alloys.

New regional sales manager for **Mechanical Specialties Co.** of Los Angeles is **W. Lee Campbell.**

Farrel-Birmingham Co., Inc., Watson-Stillman Press Div'n announces the appointment of **R. John Hess** as manager of metalworking equipment. Mr. Hess will direct sales of company's line of Farrel Watson-Stillman extrusion, metalworking and general hydraulic equipment.

The appointment of **Max E. Miles** as Service engineer in the southwest sales district has been announced by **Morse Twist Drill and Machine Co.**

The vice president in charge of Defense Contracts Organization for **Burroughs Corp.** is **Paul S. Mirabitol,** former general manager.

The newly created **Data Parts and Service Div'n of Ampex Data Products Co.** has appointed **Thomas E. Davis** manager of that division.

Gleason Works announces the appointments of **John Somerset** as new sales manager of the company, and **Irving W. Peachey,** assistant sales manager. **Ralph F. Murphy** was appointed production manager.

ANOTHER TALIDE CASE HISTORY. . .

Talide®-TIPPED HAMMERS LAST 50 TIMES LONGER!

. . . at Pulverizing Machinery Division of AMERICAN-MARIETTA COMPANY

Typical open view at right illustrates No. 3 Mikro-Pulverizer in operation.

Pulverizing Machinery Division of American-Marietta Company, Summit, New Jersey, leading producer of pulverizers, dust collectors and air conveyors, reports *longer service life* and *improved machine operation* with Talide-tipped hammers.

Forged steel hammers tipped with super-hard TALIDE METAL wear strips ⅛ x ⅜ x 2½" pulverize 50 times more tonnage than possible with alloy steel hammers on all kinds of applications, including grain, tobacco, coal, ore, minerals, etc.

TALIDE METAL . . . wear-proofs vital parts on machine tools, presses, pumps, compressors, and other types of processing equipment used in countless industries. METAL CARBIDES CORP., YOUNGSTOWN 12, OHIO

Write for Cat. 59-G today!

METAL CARBIDES CORPORATION
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HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

CIRCLE INFORM-A-GRAM KEY NO. 87

See the Hughes two-axis positioning system in operation at the ASTME Show in Los Angeles, Booth 445

Hughes two-axis control system, with positioning table, can be retrofit to almost any kind of drilling machine—single or multiple spindle—or to any other type machine requiring two-axis positioning.

Hughes numerical controls will reduce lead time, eliminate complex jigs and expensive tooling, and increase the productivity of your machine. And, they are easy to operate and service!

The Hughes Positioning Table is automatically operated from pre-programmed taped instructions. The table positions at a rate of 150 inches per minute; has repeatable accuracy to within 0.0002". Measuring circuit and drive motors are fully integrated.

Installation of this proven system is simple and fast. In many cases, all it takes is one day.

To find out more about how Hughes numerical controls can increase your profits, write, teletype (TWX INGL 4117) or call collect: Hughes Industrial Systems Division, P.O. Box 90904, International Airport Station, Los Angeles 45, California. For export information, please write: Hughes International, Culver City, California.

Creating a new world with ELECTRONICS

HUGHES

INDUSTRIAL SYSTEMS DIVISION
HUGHES AIRCRAFT COMPANY

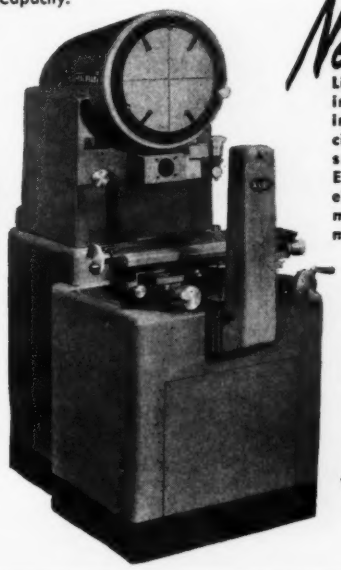
NOW! a numerical control package that can be retrofit to your present machine tool

CIRCLE INFORM-A-GRAM KEY NO. 88

EX-CELL-O CONTOUR PROJECTORS GIVE YOU MORE—

1. **LARGEST WORK AREA**—Regardless of magnification there is a constant eight inches of work space from lens to focal plane to accommodate large objects. The Model 30 has a 12" diameter capacity.
2. **UNSURPASSED ACCURACY**—Kodak optics with famed Ektar® lenses guarantee accurate measurements and give clear undistorted images over entire screen. You can depend upon optical decisions made on the Ex-Cell-O.
3. **TRUEST MEASURING PRECISION**—All Ex-Cell-O Contour Projectors read to tenths and measure to tenths. Each Ex-Cell-O contour projector is tested and checked to the highest laboratory standards before shipping.
4. **BRIGHTEST GLARE FREE SCREEN**—Coated lenses and mirrors have been standard on all Ex-Cell-O models for many years. The patented "Fresnel" lens (exclusive with Ex-Cell-O) brings entire screen into clear view from normal operator position. Sharp clear images in normal room light—the brightest and clearest in the contour projector field!
5. **MOST RUGGED CONSTRUCTION**—Built to "stand the gaff." Solid construction with optical system locked into lifetime cabinets. Will withstand factory wear and tear—without getting out of adjustment. Guaranteed by Ex-Cell-O's long experience in the manufacture of precision machine tools.
6. **SIMPLEST OPERATION**—Finger tip controls, cool to the touch lamphouses, simple setting and measuring devices, unreversed images, all add up to comfortable day long operation. A precision machine of great accuracy that can be quickly mastered by average factory inspection personnel.

MODEL 30
A True, Heavy Duty Precision Measuring Projector with 30" Diameter Screen, and 12" Diameter Capacity.



New! The Ex-Cell-O Mercury Arc Light Source Accessory. A high intensity Accessory light source including Mercury Arc Lamp, special collimator and auxiliary power supply. Quickly adaptable to all Ex-Cell-O Contour Projector Models (except Model 8) to give maximum screen brightness at higher magnifications.

Write for new booklet "See The Savings" which graphically demonstrates time savings through optical gaging over conventional methods.

MODEL 14-5
The Finest, Most Versatile, 14" Screen Contour Projector Available.

Manufactured by EX-CELL-O Corporation of Detroit, Mich.

SOLD AND SERVICED BY

OPTICAL GAGING PRODUCTS, INC.

26 FORBES STREET ROCHESTER 11, N. Y.

(A subsidiary of EX-CELL-O Corporation)

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Creating a new world with ELECTRONICS

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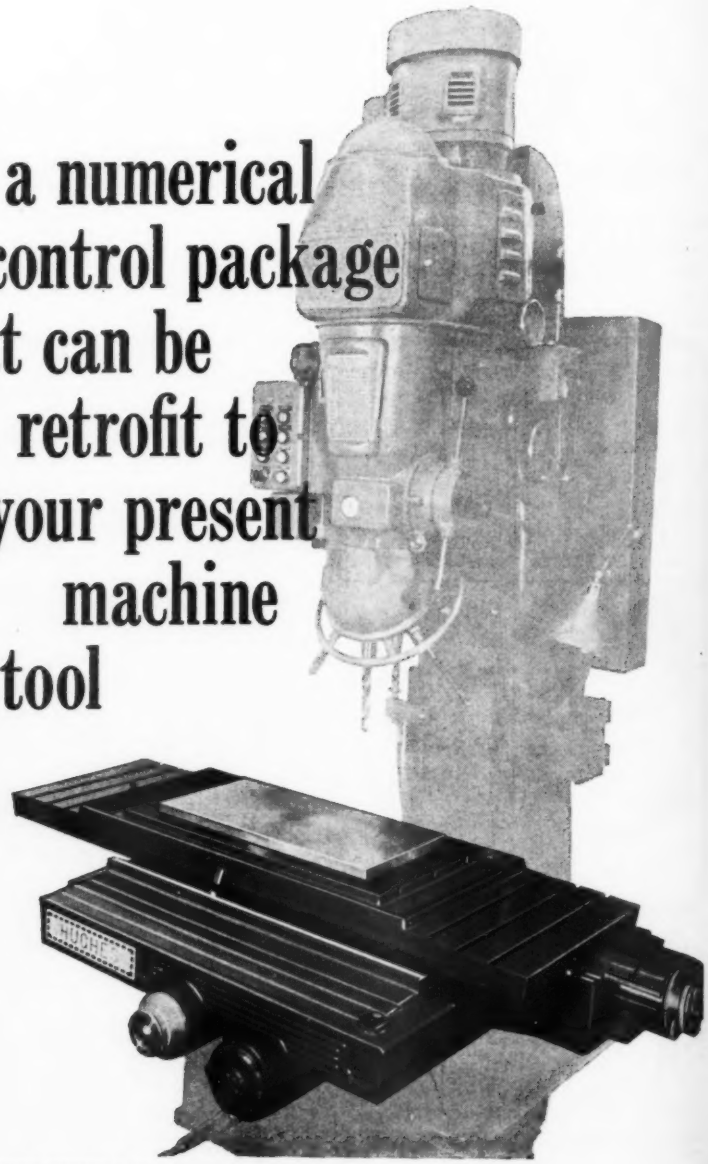
NOW! a numerical control package that can be retrofit to your present machine tool



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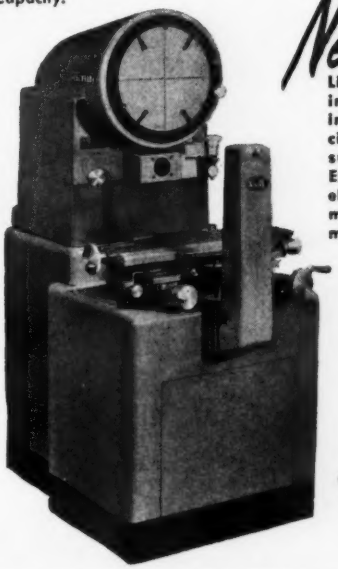
4. **BRIGHTEST GLARE FREE SCREEN**—Coated lenses and mirrors have been standard on all Ex-Cell-O models for many years. The patented "Fresnel" lens (exclusive with Ex-Cell-O) brings entire screen into clear view from normal operator position. Sharp clear images in normal room light—the brightest and clearest in the contour projector field!

5. **MOST RUGGED CONSTRUCTION**—Built to "stand the gaff." Solid construction with optical system locked into lifetime cabinets. Will withstand factory wear and tear—without getting out of adjustment. Guaranteed by Ex-Cell-O's long experience in the manufacture of precision machine tools.

6. **SIMPLEST OPERATION**—Finger tip controls, cool to the touch lamphouses, simple setting and measuring devices, unreversed images, all add up to comfortable day long operation. A precision machine of great accuracy that can be quickly mastered by average factory inspection personnel.

MODEL 30
A True, Heavy Duty Precision Measuring Projector with 30" Diameter Screen, and 12" Diameter Capacity.



New! The Ex-Cell-O Mercury Arc Light Source Accessory. A high intensity Accessory light source including Mercury Arc Lamp, special collimator and auxiliary power supply. Quickly adaptable to all Ex-Cell-O Contour Projector Models (except Model 8) to give maximum screen brightness at higher magnifications.

Write for new booklet "See The Savings" which graphically demonstrates time savings through optical gaging over conventional methods.

MODEL 14-5
The Finest, Most Versatile, 14" Screen Contour Projector Available.

Manufactured by EX-CELL-O Corporation of Detroit, Mich.
SOLD AND SERVICED BY

OPTICAL GAGING PRODUCTS, INC.

26 FORBES STREET ROCHESTER 11, N. Y.
(A subsidiary of EX-CELL-O Corporation)

CIRCLE INFORM-A-GRAM KEY NO. 89

Metallurgical Memo from General Electric

"MOVING METAL"

with Carboloy® cemented carbides

cuts manufacturing costs 3 ways

Saves machining time

Wrist-pin production increased to 2,000 per hour with Carboloy cemented carbides. Used in extruding and coining punches, higher quality General Electric carbides turn out greater quantities in less time at lower cost-per-piece. No machining (except finish grind).

Reduces metal waste

This cold extrusion punch—made of G-E Carboloy carbide results in minimum metal waste in the production of bearings. From one steel slug, this solid carbide punch forms a race and a cup; saves machining costs.

Lowers tooling cost

Rolls of Carboloy cemented carbides last many times longer than steel rolls, will handle tougher materials, result in more uniform product. This means one thing: *Lower tooling costs.* Save on time, roll replacement; improve strip quality.

For specific "moving metal" information, as it applies to your operation, write: *Metallurgical Products Department of General Electric Company, 11111 E. 8 Mile Rd., Detroit 32, Michigan.*

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMONDS
MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

CIRCLE INFORM-A-GRAM KEY NO. 90

CARBOLOY.
CEMENTED CARBIDES

NEW

MODEL III

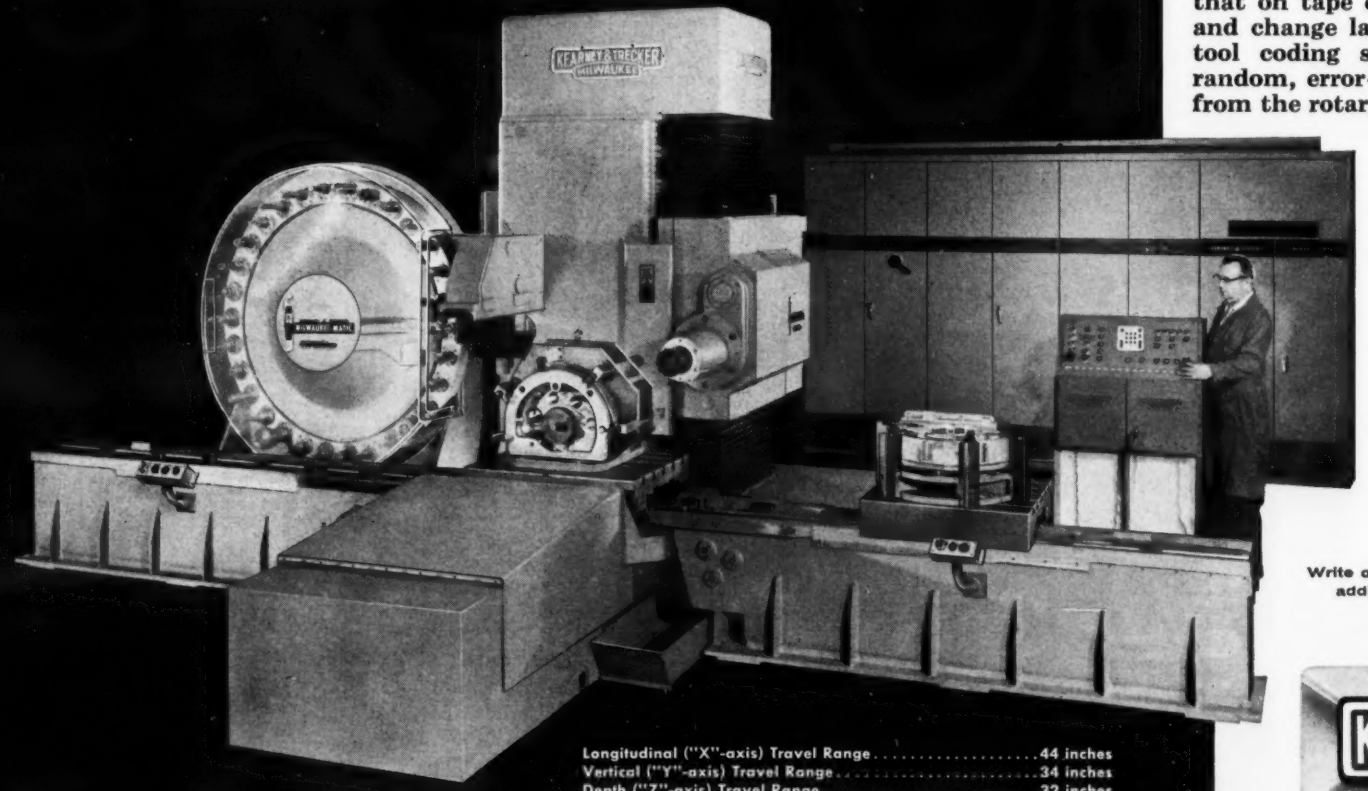
KEARNEY & TRECKER

MILWAUKEE-MATIC

WITH THE

AUTOMATIC TOOL CHANGER

that on tape command can automatically select and change large tools in 15 seconds. Exclusive tool coding system provides for the possible, random, error-free selection of 961 different tools from the rotary tool storage magazine.



This new, time-slashing, profit-producing MODEL III extends the *Manufacturing with* MILWAUKEE-MATIC *CONCEPT* to larger workpieces . . . combines high horsepower with high precision.

". . . *almost human — only better — it doesn't make mistakes*" . . . "*I see it, but I still don't believe it*" — were typical of the comments made by experienced machine tool buyers, on seeing this pace-setting MODEL III in action here at the birthplace of the *Manufacturing with* MILWAUKEE-MATIC *CONCEPT*.

Longitudinal ("X"-axis) Travel Range	44 inches
Vertical ("Y"-axis) Travel Range	34 inches
Depth ("Z"-axis) Travel Range	32 inches
Work Pallets—Surface Area	28" x 36"
Automatic Index Table—to any of 360-1° positions	at 5 rpm
Rotary Tool Storage Magazine	30 tools capacity, plus one tool in spindle
Max. Tool Dia. Automatically Changed	6 inches

Tools can be added to, or removed from any position in the magazine at any time.

Write or call for complete information on this new addition to the MILWAUKEE-MATIC family.

Numerical Control Division

KEARNEY & TRECKER MILWAUKEE

KEARNEY & TRECKER CORP.

6800 W. NATIONAL AVE. • MILWAUKEE 14, WIS.

(Phone GReenfield 6-8300 . . . Direct Distance Dialing Code 414)

CIRCLE INFORM-A-GRAM KEY NO. 91

Catalogs and other helpful literature

"Sources of Measurement Error" is a wall chart provided by Cleveland Instrument Co., and geared to the tenths and millionths accuracies now demanded of gaging systems. Heavy stock allows easy wall mounting. Get yours by circling Inform-A-Gram No. C1.

Spindle Repair is the topic of new Bulletin R-3 published by Pope Machinery Corp. It details the company's facilities for servicing all makes and sizes of belt driven, motorized, and high cycle spindles for grinding, boring, drilling and milling. Circle No. C2.

Pneumatic and Hydraulic equipment — cylinders, drill units and valves — is featured in a 24-page catalog issued by Alkon Products Corp. Your letterhead will bring a free copy from the company or Circle Inform-A-Gram No. C3.

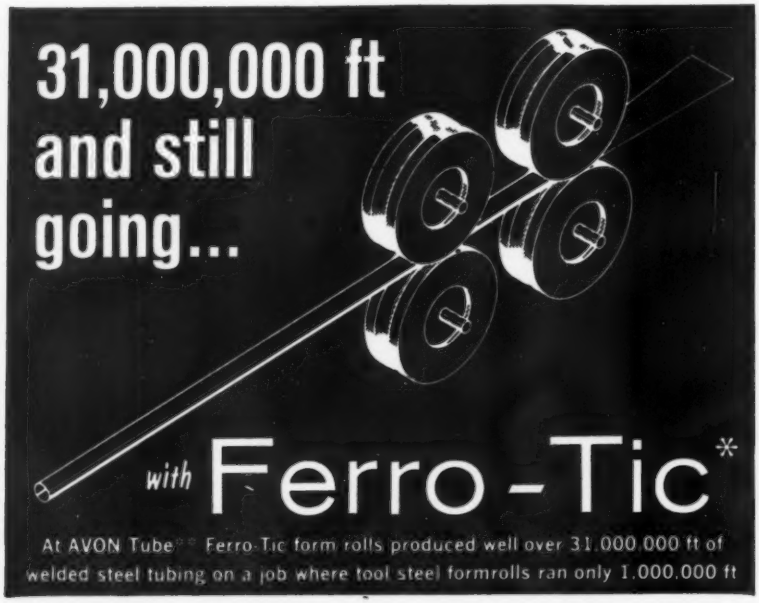
Elasticone Covers, the spirally-wound cones used to protect lead screws, shafts, pins, and bushings, are the topic of a new brochure published by the Central Safety Equipment Co. For a copy, Circle Inform-A-Gram No. C4.

Unipunch Series "A" and "AH" hole punching units, plus Series "A" notching units are described in 16-page Catalog A published by Punch Products Corp. Get a copy by Circling No. C5.

Booklet 60 is 56 pages of electric motor controls packed with descriptions, ratings, and prices for manual and magnetic starters, drum controllers, pressure, foot and limit switches. Furnas Electric Co.'s push buttons are also treated. Circle No. C6.

Erick Magnetic Tools and individual magnets are treated in Catalog 958 from Cullen Mfg. Co. Their magnetic tools include base indicator holders, base protractors, and soft jaw vise liners. Circle Inform-A-Gram No. C7.

"Utility Presses" is the name of a new folder from Lempco Industrial, Inc., which details a line with capacities ranging from 25 to 150 tons. Included are specs on platen presses, hydraulic shop presses, plus trunnion and arbor models. Circle Inform-A-Gram No. C8 for your free copy.


31,000,000 ft
and still
going...
with Ferro-Tic*
At AVON Tube** Ferro-Tic form rolls produced well over 31,000,000 ft of welded steel tubing on a job where tool steel formrolls ran only 1,000,000 ft

FERRO-TIC (the only machinable carbide in existence) combines the fabricating advantages of steel with the wear-resistance of carbide. In the annealed, completely dense state, **FERRO-TIC** can be machined with high-speed tools on conventional tool room equipment; thus, the need for costly diamond grinding is eliminated. Once hardened, by oil quenching from 1750°F, **FERRO-TIC** is extremely hard and wear-resistant. **FERRO-TIC** stock blanks can be fabricated into long-wearing components, using available tools and skills without delay! **FERRO-TIC** is ideal for: Blanking, Lamination, Deep Drawing and Heading Dies, Arbors, Core Rods, Wear Parts, etc. **FERRO-TIC** can be turned, drilled, milled, sawed, tapped. . . .

AGENTS THROUGHOUT THE U.S.A.
WRITE FOR ILLUSTRATED BULLETIN P-9

Sintercast

Division of **CHROMALLOY CORPORATION**
134 Woodworth Ave. • Yonkers 2, N.Y. • YOnkers 9-6767
CHROMALLOY DIVISION, WEST NYACK, NEW YORK
CHROMIZING CORPORATION, LOS ANGELES, CALIF.
PROPELLEX CHEMICAL DIVISION, EDWARDSVILLE, ILL.
ELYRIA FOUNDRY DIVISION, ELYRIA, OHIO

*Reg. U.S. Trade Mark
**AVON Tube Div.
HIGBIE Mfg. Co.

CIRCLE INFORM-A-GRAM KEY NO. 92

SAVE THIS AD FOR CHECKING FUTURE REQUIREMENTS

WHY WAIT? DELIVERY FROM STOCK

SPECIAL RH & LH HIGH SPEED TAPS • DIES • THREAD PLUG & RING GAGES

NEW SIZES ADDED DAILY . . . IF NOT LISTED— WRITE

DEALER INQUIRIES INVITED

WHEN REQUESTING QUOTATIONS ALWAYS MENTION QUANTITIES

SIZE	THREADS PER INCH
0000	160
000	120
00	90-96-112
0	56-64-72-76-80-90
1	48-56-60-64-80-90
2	48-52-54-56-60-72-80-96
3	36-40-60-64-72-80
4	30-32-38-42-44-56-60-64-72-80-90
5	22-27-30-32-36-38-42-48-50-56-60-64-72-80
6	24-28-30-36-38-42-44-48-56-60-64-72-80
7	28-30-32-34-36-38-40-44-48-64
8	24-26-28-30-38-40-44-48-56-60-64-72-80
9	24-28-30-32-36-40
10	18-20-22-26-28-30-34-36-40-48-56-60-64-72-80-96
11	20-22-26-27-30-32-36-40
12	20-22-26-27-30-32-36-38-40-48-56-60-64-72-80
13	20-22-24-28-32-40
14	14-16-18-26-28-30-32-36-40-64
15	18-20-24-28-32-40
16	16-18-20-22-24-28-32-36
17	16-20
18	16-18-20-24-32-40
19	18-20
20	14-16-18-20-24-32
22	16-18-20-24
24	14-16-18-22-24
26	14-16-20-24
28	14-16-20
30	14-16-20
1/16	56-60-64-72
5/64	56-60-64-72
3/32	32-36-38-48-50-56-60-64
.100	100
.107	52
7/64	36-40-42-44-48-50-56
1/8	30-32-36-38-40-48-56-60-80
.132	50
9/64	30-32-38-40
.148	38
5/32	24-26-28-30-32-36-38-40-50
11/64	24-26-30-32-36-38-40
3/16	12-18-20-22-24-26-27-28-

SIZE	THREADS PER INCH
3/16	30-32-36-40-48-56-64-72
.198	24
13/64	24-28-30-32-36-40
7/32	20-22-24-26-27-28-30-32-36-38-40-50-56-60-64-72
.227	24
15/64	20-22-24-28-32-36-.246-40
.246	40
1/4	10-12-14-16-18-22-23-24-25-26-27-30-32-36-38-40-48-50-56-60-64-72-80
17/64	12-18-20-24-27-28-32-40
.277	40
9/32	16-18-20-24-26-27-28-32-36-40-46-56
19/64	18-24
.300	28
5/16	10-12-14-16-20-22-26-27-28-30-32-36-40-44-48-50-56-64
21/64	16-18-20-24-36
11/32	16-18-20-22-24-26-27-28-32-36-40-64
23/64	16-24
.365	28
3/8	10-12-14-18-20-22-26-27-28-30-32-36-40-44-48-56-64-72
25/64	14-16-18-20-24-27-32-40-48
.402	24
13/32	12-14-16-18-20-24-27-28-32-36-40
27/64	14-20-24-28-32-36
7/16	10-12-16-18-22-24-26-27-28-30-32-36-40-48-56
29/64	12-14-16-20
15/32	12-14-18-20-24-27-28-32-36-40
31/64	13-20-24-32
1/2	10-11-12-14-16-18-22-24-26-27-28-30-32-36-40-44-48-56-70-72-80
33/64	12-13-20-24
17/32	10-12-13-14-16-18-20-24-27-28-32-40-64
.550	24
9/16	10-13-14-16-20-24-26-27-28-30-32-36-40-48-56-80
37/64	10-12-18-20-27
19/32	12-18-20-24-28-32-36-40

SIZE	THREADS PER INCH
5/8	9-10-12-13-14-16-20-24-26-27-28-30-32-36-40-48-56-64
41/64	11-18-24-32
21/32	10-11-18-20-24-27-32-40-48
.664	32
11/16	10-11-12-14-16-18-20-22-24-26-27-28-30-32-36-40
23/32	11-12-16-18-20-24-27-32-36-40
47/64	10-12-16-18-20
3/4	6-8-9-11-12-14-15-18-20-22-24-26-27-28-30-32-36-40-48-60-72
49/64	10-16-18-20
25/32	10-12-16-18-20-24-27-32-40
.800	16
13/16	8-10-12-14-16-18-20-24-27-28-32-40
.835	16
55/64	6-12
27/32	9-10-18-20-24-27-32-40-48
.850	14
7/8	8-10-11-12-13-16-18-20-24-26-27-28-30-32-36-40
29/32	9-12-14-18-20-24-27-28-32
15/16	8-9-10-12-14-16-18-20-24-26-27-28-32-40
31/32	8-9-12-16-18-20-24-28-32
1	5-7-9-10-11-12-16-18-20-24-26-27-28-30-32-36-40-48
1-1/32	8-12-14-16-18-20
1-3/64	12-14-16-18-20
1-1/16	7-8-10-12-14-16-17-18-20-24-27-28-32-40
1-3/32	7-8-9-12-14-16-18-20-32-40
1-1/8	8-10-14-16-18-20-24-27-28-32-40-48
1-5/32	7-8-9-12-14-16-18-20-24-32
1-11/64	18
1-3/16	7-8-10-12-14-16-18-20-24-27-28-32-40
1-1/4	8-10-14-16-18-20-24-27-28-32-40
1-5/16	6-7-8-10-12-14-16-18-20-24-27-28-32-40-48
1-3/8	5-8-10-14-16-18-20-24-27-28-32-40
1-13/32	12-16-18-20
1-7/16	6-8-10-12-14-16-18-20-24-27-28-32-40

SIZE	THREADS PER INCH
1-1/2	7-8-9-10-13-14-16-18-20-24-27-28-32-40
1-17/32	7-12-16-18-20
1-9/16	8-10-12-14-16-18-20-24-32-40
1-5/8	5-5½-6-8-10-11½-12-13-14-16-18-20-24-28-32-40
1-11/16	8-10-12-14-16-18-20-24-32
1-23/32	5-8-12-16-18-20
1-3/4	5-6-8-10-12-13-14-16-18-20-24-28-32-40
1.767	18
1.7715	12
1-13/16	8-10-12-14-16-18-20-24-32
1-7/8	5-8-10-12-14-16-18-20-24-32
1-29/32	12-16-18-20-32
1-15/16	8-10-12-14-16-18-20-24-32
2	4½-6-8-10-12-14-16-18-20-24-28-32
2-1/16	8-10-12-14-16-18-20-24-32
2-1/8	4½-8-10-12-14-16-18-20
2-3/16	8-10-12-14-16-18-20-24
2-1/4	4½-8-10-12-14-16-18-20-24
2-5/16	8-10-12-14-16-18-20-24
2-3/8	4-8-10-12-14-16-18-20-32
2-7/16	8-10-12-14-16-18-20
2-1/2	4-6-8-10-12-14-16-18-20
2-9/16	8-10-12-14-16-18-20
2-5/8	4-8-10-12-14-16-20-32
2-11/16	8-10-12-14-16-18-20-32
2-3/4	4-8-10-12-14-16-18-20-32
2-7/8	4-8-10-12-14-16-18-20-24-32
2-15/16	8-10-12-14-16-18-20-32
3	3½-4-8-10-12-14-16-18-20
3-1/16	4-8-10-12-14-16-20
3-1/8	4-8-10-12-14-16-20
3-3/16	4-8-10-12-14-16-20
3-1/4	4-8-10-11-12-14-16-18-20
3-3/8	4-8-10-12-16
3-1/2	4-8-10-12-16
3-5/8	4-8-10-12-16
3-3/4	4-8-10-12-16
3-7/8	4-8-10-12-16
4	4-6-8-10-12-16
4-1/8	4-8-10-12-16
4-1/4	4-8-10-12-16

Many more sizes in stock up to 6" dia.

LEFT HAND N.C. (USS)—N.F. (SAE) SIZES

SEE ABOVE SECTION FOR MORE SIZES

SIZE	THREADS	SIZE	THREADS	SIZE	THREADS	SIZE	THREADS
0	80	8	32-36	7/16	14-20	1"	8-12-14
1	64-72	10	24-32	1/2	13-20	1-1/8	7-12
2	56-64	12	24-28	9/16	12-18	1-1/4	7-12
3	48-56	14	20-24	5/8	11-18	1-5/16	6-12
4	36-40-48	1/4	20-28	11/16	11-16	1-3/8	6-12
5	40-44	5/16	18-24	3/4	10-16	1-7/16	6-12
6	32-40	3/8	16-24	7/8	9-14	1-1/2	6-12

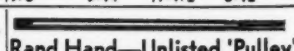
'OVERSIZE' and 'UNDERSIZE' TAPS

RIGHT AND LEFT HAND N.C. AND N.F. SIZES

MACHINE SCREW	#2 to #5	Plus or Minus	.002, .003, .005
MACHINE SCREW	#6 to #14	Plus or Minus	.003, .005, .010
FRACTIONAL	1/4" to 1-1/2"	Plus or Minus	.003, .005, .010 .015, 1/64, 1/32

Right & Left Hand—Unlisted 'Gun' or Spiral Pointed Taps

Size	Threads	Size	Threads
0	80 NF		
1	56 NS		
2	56 NC, 64 NF	7/8	9 NC, 14 NF
9/16	12 NC, 18 NF	1	8 NC, 12-14 NF
5/8	11 NC, 18 NF	1-1/8	7 NC, 12 NF
11/16	11 NS, 16 NS	1-1/4	7 NC, 12 NF
3/4	10 NC, 16 NF	1-3/8	6 NC, 12 NF
		1-1/2	6 NC, 12 NF



Rand Hand—Unlisted 'Pulley' And Extra Length Taps

Size	Threads	Size	Threads
4	36-40 NC, 48 NF	3/8	24-NF
5	40 NC, 44 NF	7/16	20 NF
6	32 NC, 40 NF	1/2	20 NF
8	32 NC, 36 NF	9/16	12 NC
10	24 NC, 32 NF	9/16	18 NF
12	24 NC, 28 NF	5/8	18 NF
1/4	28 NF	3/4	16 NF
5/16	24-NF	Also Larger Sizes	NC & NF

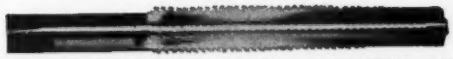
UNLISTED Right Hand "Pipe" Taps

"NPT" Taper "NPT" Size	Thread	"NPS" Size	Thread	EX. LENGTH "NPT" & "NPS" Size	Thread
1/16	27	1/16	27	1/16	27
1/4	27	1	8	1/8	27
2-1/2	8	1-1/4	11½	1/4	18
3	8	1-1/2	11½	3/8	18
3-1/2	8	2	11½	1/2	14
4	8	2-1/2	8	3/4	14
Also British		3	8	1	11½
		3-1/2	8	Also British	
		4	8		
		Also British			

Lefthand 'Pipe Taps' Taper and Straight

Size	Thread	Size	Thread
1/16	27	1	11½
1/8	27	1-1/4	11½
1/4	18	1-1/2	11½
3/8	18	2	11½
1/2	14	2-1/2	8
3/4	14	3	8
Also British		3-1/2	8
		Also British	

ACME TAPS IN STOCK



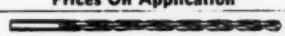
IF NOT IN STOCK—7 to 10 DAYS DELIVERY—When ordering or requesting quotations, kindly furnish following information:

(a) Kind of material being machined.
(b) Depth of hole in inches, through or bottom.
(c) Tap to be used horizontally or vertically.
(d) Will tap turn, or is piece expected to be turned.
(e) Is tapping job expected to be done in one pass.
(f) Would tap be backed out of hole, or machined stopped for release of tap.
(g) If possible, submit thread length, and overall length of tap desired with blue print.

SPECIAL REAMERS

Immediate Delivery

H.S.S.S. Machine Reamers Decimal, Fractional, Letter, and Wire Gauge Sizes Prices On Application



SPECIAL—Right Hand High Speed "EXTRA LENGTH DRILLS" "AND LEFT HAND DRILLS" In Stock for Immediate Delivery

Get all 3 . . .
- ☑ DELIVERY
- ☑ QUALITY
- ☑ PRICE

at

FIELD TOOL SUPPLY CO.

Industrial Cutting Tools

31 S. DESPLAINES ST., CHICAGO 6, ILL.

All Phones: Financial 6-1195

The Largest Stock of SPECIAL and STANDARD TAPS, DIES, PLUG GAGES

CIRCLE INFORM-A-GRAM KEY NO. 93

Hardened, Tempered and Ground-from-the-Solid!

It pays to specify

ACE

DRILLS
REAMERS
BLANKS

Premium Quality
High Speed Steel,
Solid Carbide and
Carbide Tipped.

ACE DRILL SETS
Standard stock sets include Fractional, Wire and Letter size drills, packaged in convenient folding index cases.

ACE BLANK SETS
Uniformly hardened high speed steel reamer and drill blanks precision ground to new close tolerance limits available in standard Fractional, Wire and Letter series sets.

Call your local distributor today—or write Ace direct for latest catalog and price information.

ACE DRILL
Adrian, Michigan
ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS
CIRCLE INFORM-A-GRAM KEY NO. 941

H◯LES
JIG GROUND
with *Vulcanaire*

Provide your tool room with this inexpensive instrument for use on your present equipment and Jig Grind with a guarantee.

Borrow our instructive 11 minute movie on Jig Grinding.

Your Tool Room in Dayton
Designers and Builders
Special Tools — Dies — Machines
Request Quotation

VULCAN tools
VULCAN TOOL CO.
734 LORAIN AVENUE
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Catalogs . . .

High Pressure Fittings and hoses made by Parker-Hannifin Corp. are described in 12-page Catalog 4430 just released by the firm. It includes data on flange head ends and bent tube fittings with 37° swivel nuts just added to the line. Circle Inform-A-Gram No. C9.

Molykote Lubricating Sticks are discussed in pocket-sized Folder 605 from Alpha-Molykote Corp. Get a free copy by circling Inform-A-Gram No. C10.

Swaging Machines — the complete line made by Fenn Mfg. Co. — are covered in a 20-page catalog published by the company. Catalog SM-60 includes the firm's line of feeding accessories, and other related equipment. Circle Inform-A-Gram No. C11.

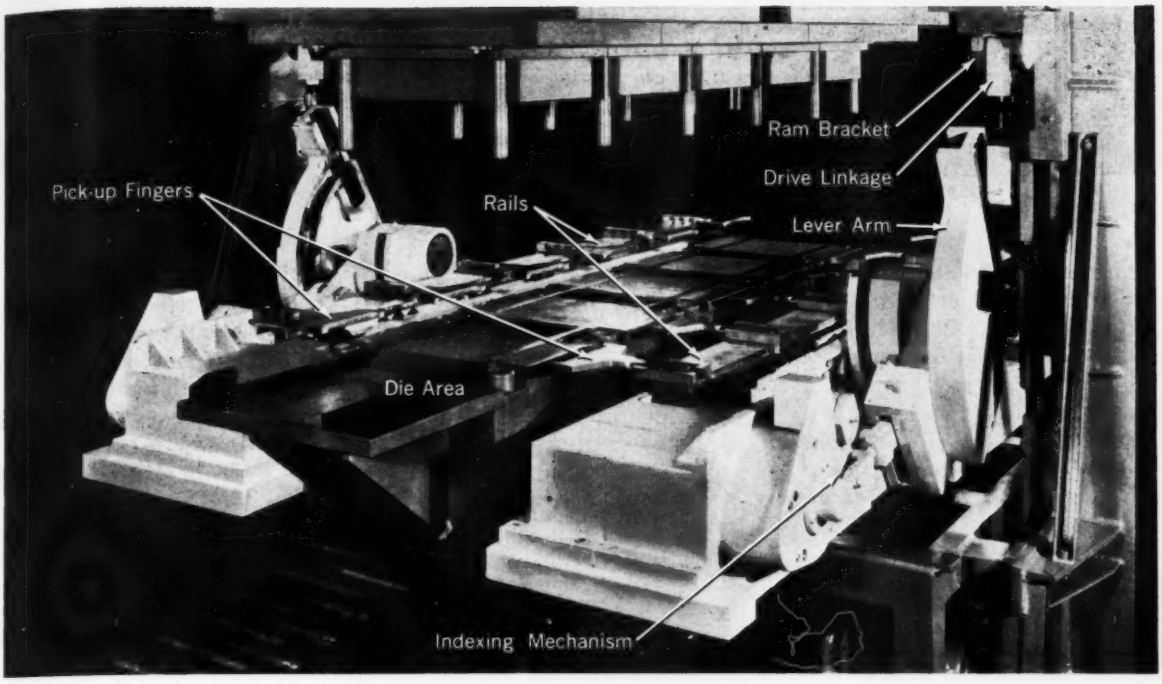
O-Vee Gages for measuring thread pitch diameter are featured in a new brochure available from Scherr-Tumico. Circle Inform-A-Gram No. C12.

The Linearscope, a Scherr-Tumico precision instrument for measurement, is covered in a new brochure. The unit features 4" x 12" coordinate travel. Request your free copy by circling Inform-A-Gram No. C13.

Clamp Assemblies, fixture details, spring plungers, torque screws, chuck jaw blanks and uniklamps — data on all these fills the 54-pages of Universal-Engineering Co.'s Catalog 1110. Circle Inform-A-Gram No. C14.

Some 500 Throwaway insert milling cutter styles and sizes are listed in a new 24-page booklet authored by Valenite Metals. It's entitled "The V. M. U. System of Milling," and includes data on cutter bodies, cartridges, inserts and accessories for metal cutting. Circle Inform-A-Gram No. C15.

"Light - Heavyweight Machine Tools" is the name of a comprehensive, 52-page booklet issued by the Walker-Turner Div., Rockwell Mfg. Co. It includes information on band saws, belt and disc finishers, cut-off machines, drill presses and grinders. Circle No. C16.



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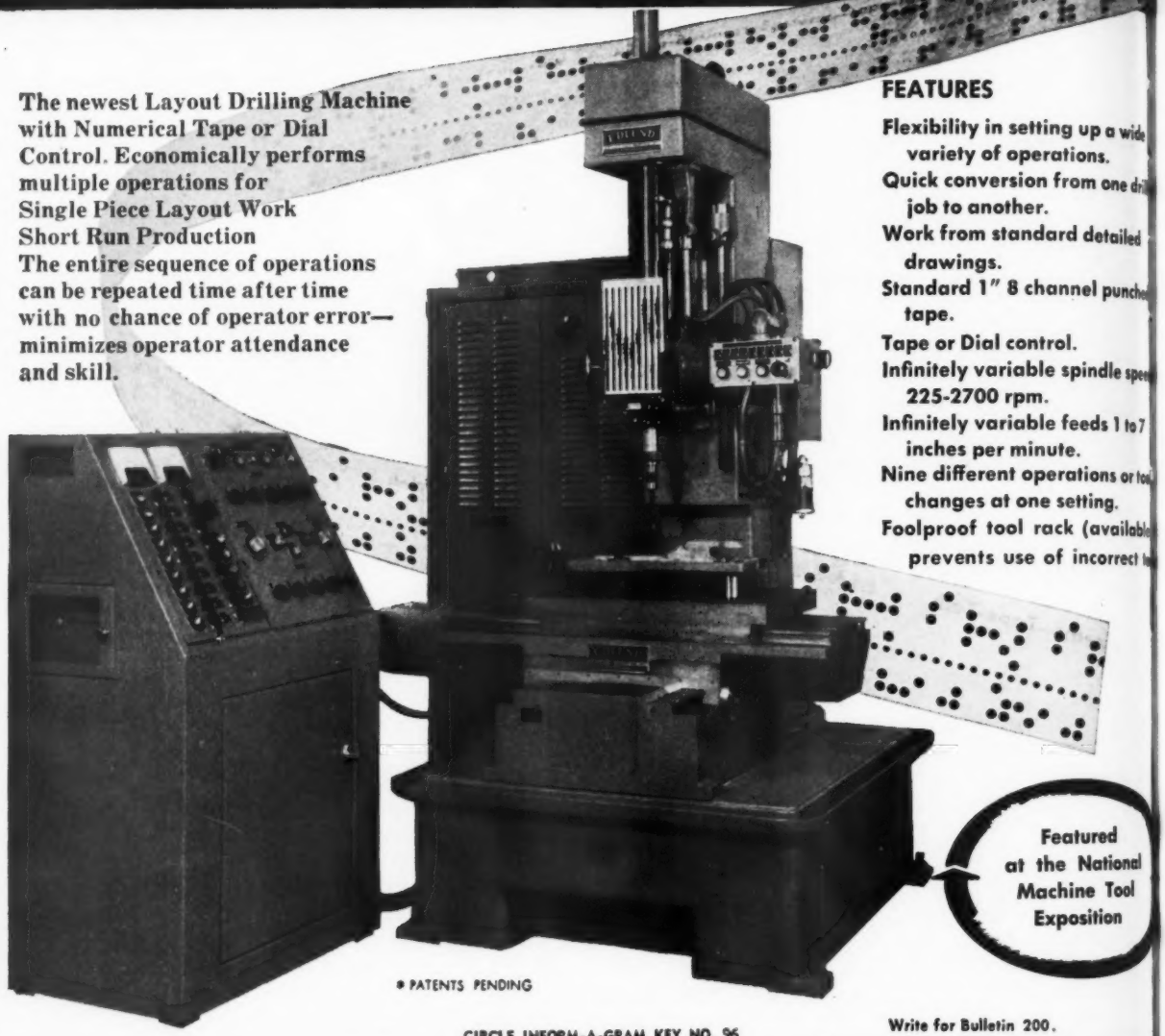

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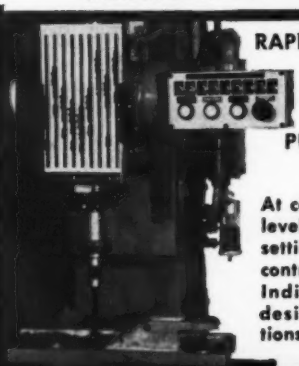

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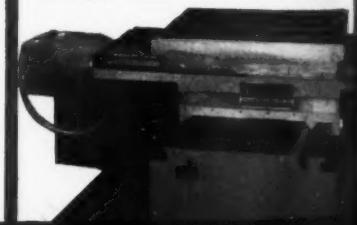

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Catalogs . . .

Portable Air Tools for screwdriving and nutsetting fill 16-page Catalog N.S. 60 released by Master Power Corp. It lists pistol grips, slip chucks for rapid bit change, and a variety of bits. Circle Inform-A-Gram No. C17 for a copy.

The 18 Standard cartridge-type toolholders that comprise the Wesson Co. insert-cartridge system for assembling a variety of single or combination boring, facing and recessing tools are described in Bulletin C-660. It's yours for circling Inform-A-Gram No. C18.

A Pamphlet containing instructions on the use of adjustable boring and reaming tools is available from Muskegon Tool Industries, Inc. Circle Inform-A-Gram No. C19 for a free copy.

Machinery Clutches and brakes made by the Wichita Clutch Co., Wichita Falls, Tex., are detailed in the firm's new 32-page catalog which sets forth a variety of applications. Circle Inform-A-Gram No. C20.

A New Rotary Transfer machine especially suited for automatic parts assembly is treated in Catalog 602 published by Ferguson Machine Corp. User merely adds chucks or collets to handle the parts he wants to assemble. Circle Inform-A-Gram No. C21.

Supervisors, department heads and foremen can profit from "Guidance That Pays," a publication designed to help them toward efficient handling of managerial responsibilities. Get a free copy from Elliot Service Co., or Circle Inform-A-Gram No. C22.

Honing Machines, tools and abrasives are the topic of a 16-page catalog, No. 200, put out by Barnes Drill Co. Included are charts listing spindle speeds and coolants for various honing jobs. Circle Inform-A-Gram No. C23.

Price Reductions and new materials from Cadillac Plastic and Chemical Co. are given in the firm's new 64-page catalog that details plastic in sheet, rod, tube and film forms. Ask for it by cir-Inform-A-Gram No. C24.

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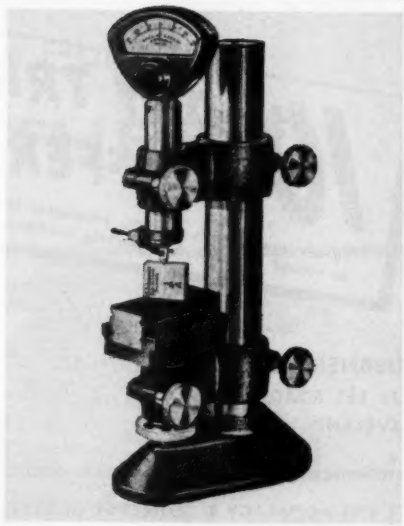

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510-E6	0".0008	0".00001
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510-E9	0".00008	0".000001
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- ☐ **PRODUCTION CONTROL** by Nyles V. Reinfeld. 1959; 340 pages. A practical guide to the principles and functions of production control—details forecasting, scheduling and inventory techniques—incorporates up-to-date research from 500 companies. **$8.00**
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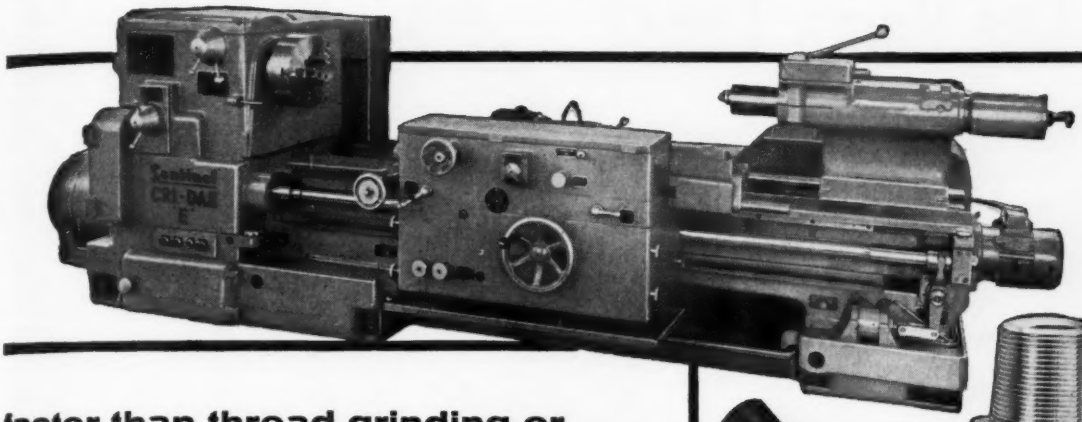

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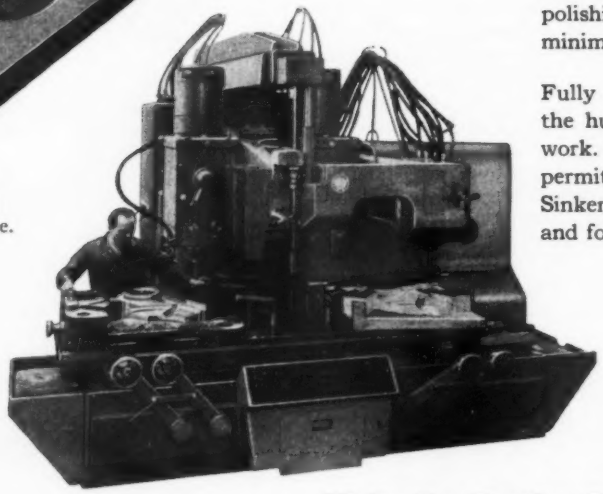

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CIRCLE INFORM-A-GRAM KEY NO. 100

Catalogs . . .

Wire Brushes, hammers, scrapers, pliers, shovels, wrenches, etc., are detailed in new Bulletin ST-5 available from Ampco Metal, Inc. Features of this "safety line" are their non-sparking, non-corrosive qualities. Circle Inform-A-Gram No. C25.

Solid Lubricants — the theory and use of molybdenum disulfide types — are covered in 24-page Bulletin 124 available from the Alpha-Molykote Corp. It's free if you circle No. C26.

Tool Bits made of tungsten-base high vanadium, high cobalt high speed steel — called Circle T-15 bits by Firth Stirling, Inc., are described in the company's new catalog section. Circle Inform-A-Gram No. C27 for a copy.

Glass Fiber characteristics, specifications, and applications are described in new literature from Fibrous Glass Products, Inc., a sub. of Pall Corp. Get a copy from the company, or Circle No. C28.

Pocket Scribers, magnets, fixed point scribers, screw drivers, and knife blades are described in several bulletins that have been announced by Spring Specialty Co. Get copies, or Circle No. C29.

OBI Power Presses in the 75- to 200-ton capacity range are described in an eight-page folder

available from Cleveland Punch & Shear Works Co. Ask for folder OBI-3'60 from the company, or Circle Inform-A-Gram No. C30.

Manhattan Diamond Wheels data are presented in a catalog which gives available grit sizes and diamond concentrations and tips to prolong wheel service. Get Catalog M1501 from Abrasive Wheel Dept., Manhattan Rubber Div'n, Raybestos-Manhattan, Inc., or Circle Inform-A-Gram No. C31.

A Process Gas Chromatography instrument for furnace and controlled atmosphere applications, Model 184B furnace atmosphere analyzer, is described in a bulletin. Operation, installation, specifications, and sensitivity limits are described. Get a copy from Perkin-Elmer Corp., or Circle No. C32.

A 20-Page Booklet details selected natural diamond grit (both treated and untreated, its advantages, and the most beneficial applications to diamond wheel users. Get "This Is SND" from Industrial Diamond Div'n, Engelhard Hanovia, Inc., or Circle Inform-A-Gram No. C33.

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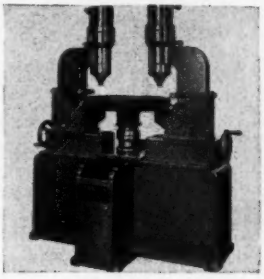

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CIRCLE INFORM-A-GRAM KEY NO. 101

Catalogs . . .

Axial Piston Pumps at hydraulic pressures to 5000 psi are explained in a brochure. Performance and torque curves and rating charts are included. Get Bulletin 203 from Denison Engineering Div'n, American Brake Shoe Co., or Circle Inform-A-Gram No. C34.

Four Types of rust preventive compounds are presented in a new bulletin which describes the physical properties and applications of the Anarust types. Contact Wheelabrator Corp., Techline Div'n, for Bulletin 1001, or Circle Inform-A-Gram No. C35.

The Quick Beveler described in a bulletin can save up to 85% of the costs of preparing joints for welding. Typical applications, capacities, and dimensions are discussed. Get a copy from American Pullmax Co., Inc., or Circle Inform-A-Gram No. C36.

Industrial Box Kilns, designed for operating temperatures to 2750°F, are described in two bulletins. Typical heating and cooling curves, dimensions, and capacities are given. Get copies from Harper Electric Furnace Corp., or Circle Inform-A-Gram No. C37.

"How To Maintain Absolute Level for Precision Applications" tells how the Serva-Levl mount works and why it is needed. Also shows an example of how a lathe is kept level with them. Write Barry Controls Inc., for your copy, or Circle Inform-A-Gram No. C38.

"Tooling Plastics in the Foundry" presents ten applications which enable savings up to 60%. Core boxes, loose pieces, spotting slugs, and match plates are a few. Get a copy from Furane Plastics Inc., or Circle No. C39.

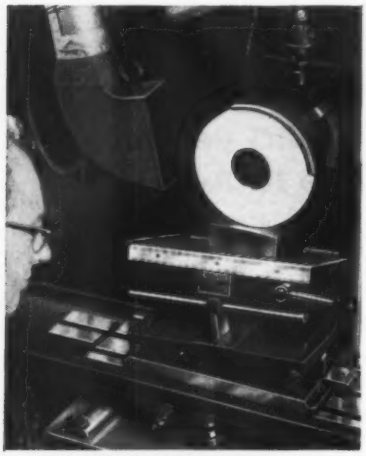
A Single Embossed Panelcoil is covered in detail in a new bulletin from Dean Products, Inc. Different types of Panelcoil, used for heating or cooling both flat and curved surfaces, are included. Get Bulletin M10 from Dean, or Circle Inform-A-Gram No. C40.

How to Use Teflon sheets, rods, tubes, tape, and other standard shapes are described in a bulletin. Get a copy from Cadillac Plastic & Chemical Co., or Circle Inform-A-Gram No. C41.

An Authoritative 22-page manual on the many uses for rubberized abrasives is available from Cratex Mfg. Co. The firm makes rubber-bonded abrasive wheels, points and sticks for micro-deburring, smoothing and polishing. Circle C42.

Their Model 35B hydraulic surface grinder is treated in Bulletin 35B60 published by Covel Mfg. Co. Its outstanding feature is the 18½" working distance between a 12" dia wheel and the table surface. Get it free by circling No. C43.

Two New Folders outline the advantages of using magnetic grip shields for machine tool guarding, and "Grippys," permanent magnets that act as clamps or jigs to aid in welding or machining setups. Get them by circling Inform-A-Gram No. C44.



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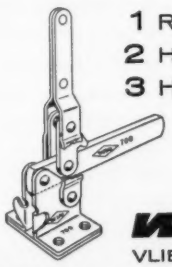

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CIRCLE INFORM-A-GRAM KEY NO. 1041

Catalogs . . .

Typical Short Run stampings produced by Dayton Rogers Mfg. Co. are mounted on a 24″ x 36″ educational display board. Costs and specs accompany the board if you request it on company letterhead, or Circle Inform-A-Gram No. C45.

Firthrite Tips, tools, toolholders and inserts are listed in 44-page Catalog TTI-60, containing prices and specs on all Firth Sterling's metal cutting products. Write the company for a copy, or circle Inform-A-Gram No. C46.

Automatic Roll Feeds for press room equipment is covered by a new catalog released by Durant Tool Supply Co. A free copy is yours if you circle No. C47.

"InFab for Producing Space Age Metals" is the title of a 12-page brochure published by Universal-Cyclops Steel Corp. It describes the company's new inert fabrication mill for handling molybdenum, columbium, tungsten, tantalum and their alloys. Circle C48.

The Fabrication of composite draw dies to eliminate galling and scratching is the topic of an article in the second quarter issue of Ampco Welding News, issued by Ampco Metal, Inc. Circle Inform-A-Gram No. C49 for a free copy.

Their Cam Locking jig vise, controlled-flo coolant pump and tank unit and soft chuck jaws are detailed in a new folder from Morton Tool Co. Get a copy by circling Inform-A-Gram No. C50.

Catalog AM-60 from Acme Mfg. Co. discusses in detail five Acme flat grinding and polishing machines, and briefly lists six abrasive belt finishers. They're suited for finishing and deburring a range of parts from printed circuit boards to sand castings. Circle No. C51.

Tools Produced by the threading tool division of National Acme Co. are listed in the firm's new 44-page booklet. Bulletin DT-60 covers Vers-O-Tool self-opening threading and hollow milling heads, collapsible and adjustable taps. Circle Inform-A-Gram No. C52 for a free copy.

*Of course, it's tough to toe such a fine tolerance line! But Acme Industrial has produced scores of parts, big and small, that meet just such exacting requirements . . . and we're talking about high volume output! America's missiles, dependent on thousandths-of-an-inch accuracy, incorporate many Acme-made parts. To lay it on the line, very few production lines have the number and variety of machines . . . the more-than-a-decade experience . . . the proved reputation for Nth degree production ability. These unique Acme capabilities can work for you.

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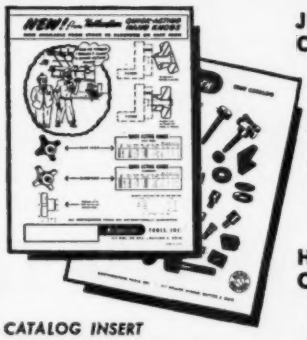

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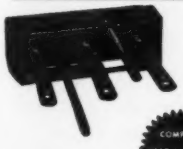

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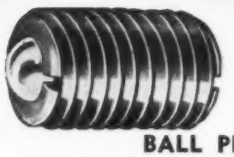

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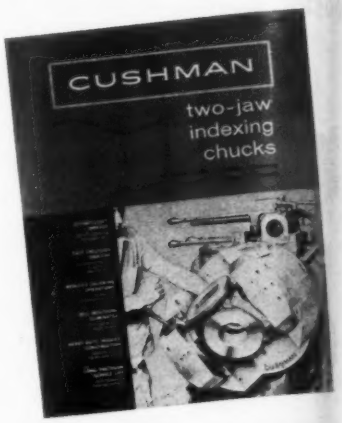
Catalogs . . .



Power and Manually-operated two-jaw indexing chucks made by Cushman Chuck Co. are treated in Bulletin 800. Request it from the company, or Circle No. C53.

Five Standard Multiple transfer presses made by Baird Machine Co. are profiled in a new 8-page brochure. The booklet also lists typical applications of the machines for high production of stamped and drawn parts. Circle cling No. C54.

Socket Head Cap Screws — the new 1960 Series manufactured by Standard Screw Co. — are introduced in a brochure. It lists the advantages of the new industry standards, and will help users in shifting from the 1936 series. Ask for it by Circling No. C55.

High Precision Parts, including prototype gears, splines, lead & feed screws, fixtures and dies, are the topic of Bulletin 100 issued by the Enterprise Div., Michigan Tool Co. Get it by Circling Inform-A-Gram No. C56.

How to Select cleaners, cutting lubricants, drawing compounds and extrusion lubricants is told in Macco Products Co.'s pocket-sized "Guide to Better Metalworking." It's yours if you Circle Inform-A-Gram No. C57.

"How to Clean Ultrasonically With Self-Tuning" is the name of Bulletin 60-1 from Powertron Ultrasonic Corp. It lists solutions and temperatures for the ultrasonic removal of some 20 common contaminants. Get it by Circling No. C58.

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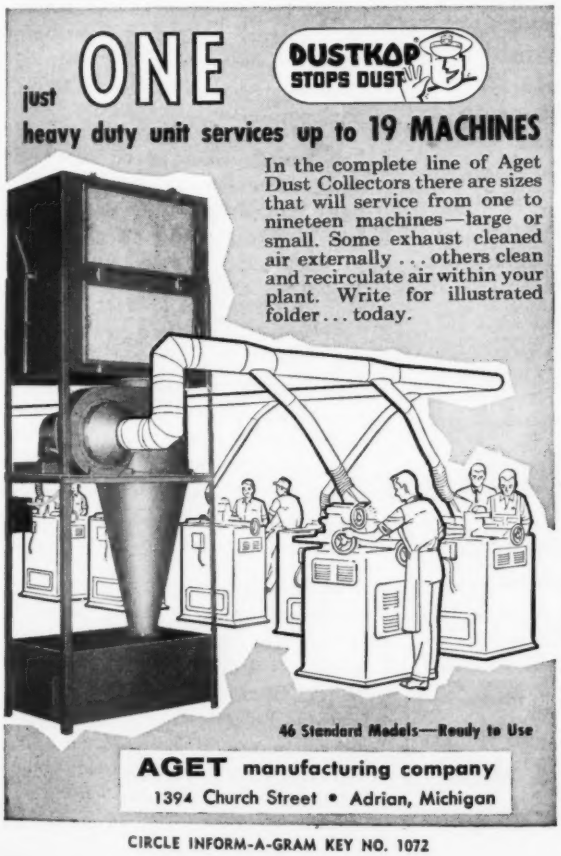
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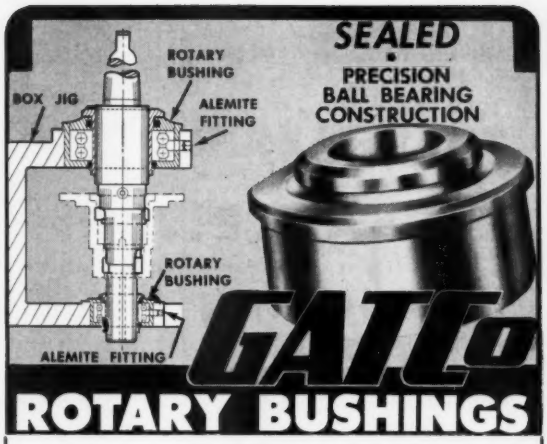

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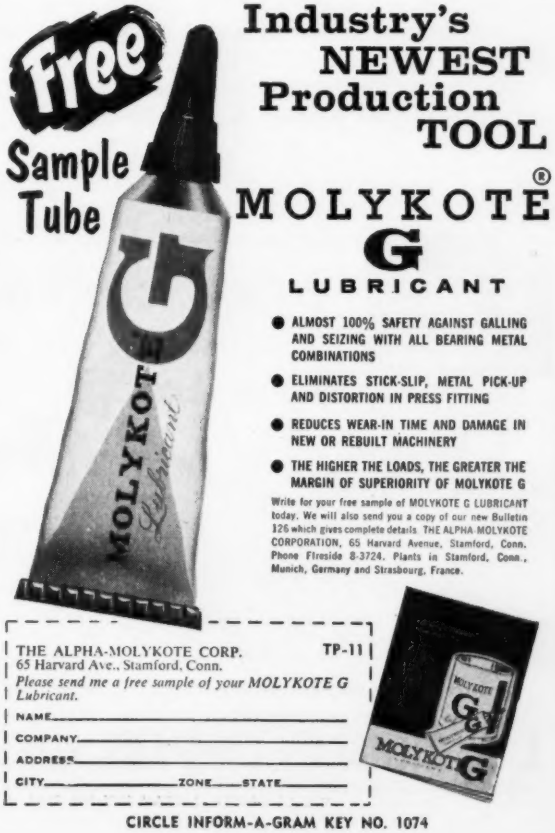
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DAKE CORPORATION

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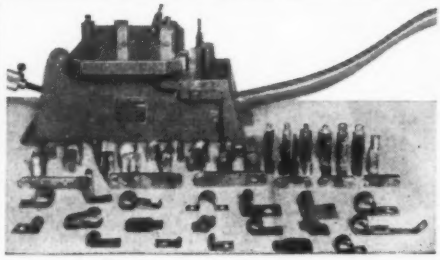

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Catalogs...

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Materials Handling Equipment — conveyors, casters, wheels, etc. — is covered in 44-page Catalog GC-1 published by The Rapids-Standard Co., Inc. It's indexed for easy reference. Circle Inform-A-Gram No. C60.

Industrial Pressure and temperature controls and solenoid valves are described in 20-page D. T. Williams Catalog 800-A issued by American Standard's Detroit Controls Div. Circle No. C61.

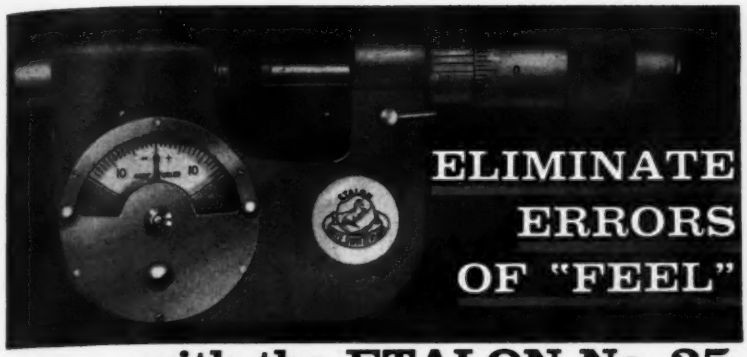
Drills, Reamers and cutters — tools made with high speed steel, solid carbide or carbide tips, are the concern of a folder published by Special Drill & Reamer Co. Get a free copy by circling Inform-A-Gram No. C62.

"Resistance Welding Control — IC-2-1960" is a new standard published by the National Electrical Manufacturers' Assn., and includes definitions and cycle diagrams for all generally used resistance welding processes. Circle No. C63.

A New Precision speed lathe, the Sixty Series, is detailed in a bulletin from Rivett Lathe & Grinder Inc. It offers a range of speeds up to 4800 rpm. Circle Inform-A-Gram No. C64.

Special Plastic Mold and die cast die bases are the topic of a 28-page catalog published by Columbia Engineering Co. It also lists their several steels and machining services for plastic injection, compression and stripper mold bases, and die cast die bases. Circle Inform-A-Gram No. C65.

Hydraulic Products are keyed alphabetically for quick reference in a new 74-page publication. Vickers Incorporated's Catalog 5001C includes data on servo valves and systems, vane pumps, piston pumps, directional controls, variable speed drives and hydraulic cylinders. Circle No. C66.



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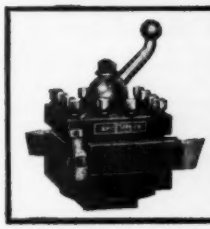
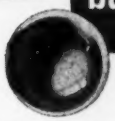
Enco Turrets Assure ±.0005" Accuracy



by being on the ball!



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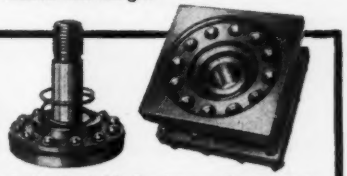

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There's an ENCO turret for every lathe.

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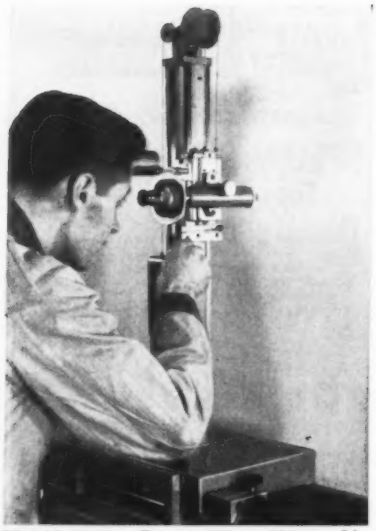

M1238-1818 — *Range 18" x 18", working distance 9" to infinity. Reads to 0.001" up to 24" working distance. Protractor ocular reads to 3 minutes of arc. Image is erect.*

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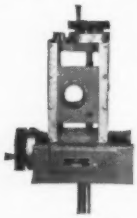
M1236-46— Horizontal range 6", vertical range 4". Reads to 0.0001", working distance 5" to infinity.



M1236-22— Range 2" x 2", reads to 0.0001". Working distance 5" to infinity. Shown with 19 mm mounting rod, and without telemicroscope. Instrument permits precise coordinate movement of other objects such as photo cells, probes, etc., in place of telemicroscope.

Write for Bulletin 188-53

The Gaertner Scientific Corporation

1242 Wrightwood Ave., Chicago 14, Ill.
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CIRCLE INFORM-A-GRAM KEY NO. 1101

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998 Broadway, Bedford, Ohio, BEdford 2-2800. Tooling, Short Run Production and Machined Parts for Automation.

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Do not scrap dull files. BBF Precision Grinding (BBFPG) resharpens dull files to new file efficiency: any length shape or cut. Results guaranteed. No acids or annealing. Ship dull files to sharpen to FACTORY: Beaver Falls, Pa.

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CIRCLE INFORM-A-GRAM KEY NO. 1102

Catalogs . . .

Worm Gear Speed Reducers, the fan-cooled type made by Link-Belt Co., are the subject of Book 2824, the firm's new 66-page publication. They're available with torque ratings up to 135,000 pound-inches, and horsepower ratings to 150. Circle No. C67.

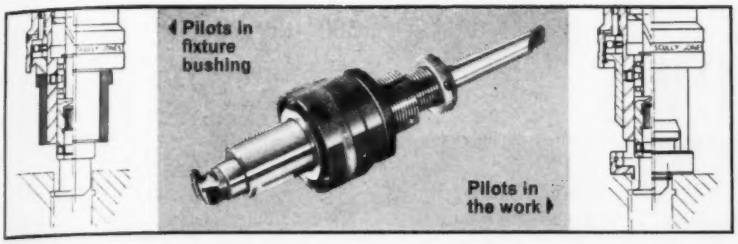
Contour and Conventional grinding, boring and turning machines in their 900 Series are described in a new folder from Frauenthal Div., Kaydon Engineering Co. Standard and optional features, such as tracer and numerical control, are listed. Circle No. C68.

Re-usable Hydraulic Hoses, couplings and fittings in the Anchor Coupling Co.'s line are set forth in a 21" x 32" wall chart available for fluid power users. Request it by Circling Inform-A-Gram No. C69.

A 27-page report from Sciaky Bros., Inc., is a pictorial review of the firm's automatic fusion welding equipment. It's free if you Circle Inform-A-Gram No. C70.

A New Folder extols Whitmore Mfg. Co.'s aerosol lubricant for open chains. It's said to triple chain life, by acting as a penetrant and rust-preventive, as well. Get a free copy by Circling Inform-A-Gram No. C71.

"One-Piece Self-Locking Screws and Bolts" is the name of a new booklet that describes Continental Screw Co.'s line with Holtite Nylok inserts. Get it by Circling Inform-A-Gram No. C72.



building-block design boosts recessing tool work range

The building-block design principle used in Scully-Jones new automatic recessing tools increases work range of each tool, reduces inventories and tooling costs. Designed for use in drill presses, radial drills, and special machines, these new tools cover a range of work hole diameters from ¼" to 4½" and depth of cut to .300".

Four sizes of tools are available with interchangeable stop collars and pilot nose assemblies for piloting either in fixture bushings or in the work. Three sizes of tools are provided for piloting in the work only, and come with standard pilot nose blanks which can be machined to hole size requirements. Both types of tool are available with concentric *or* eccentric tool bit mounting, depending on the tools to be used and type of work. Feed is automatic and continuous, controlled by a lead cam in the tool. Adjustable collars speed setting for location, depth of cut.

For complete information, contact your Scully-Jones representative or distributor: or call direct, BIshop 7-5900

Scully-Jones and Company
1913 South Rockwell Street, Chicago 8, Illinois

Micrometer fixture for grinding circular form tools—eliminates cut and try.

Presetting gage sets tools for location, depth of undercut.

SCULLY JONES **RECESSING TOOLS**

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ADJUSTABLE
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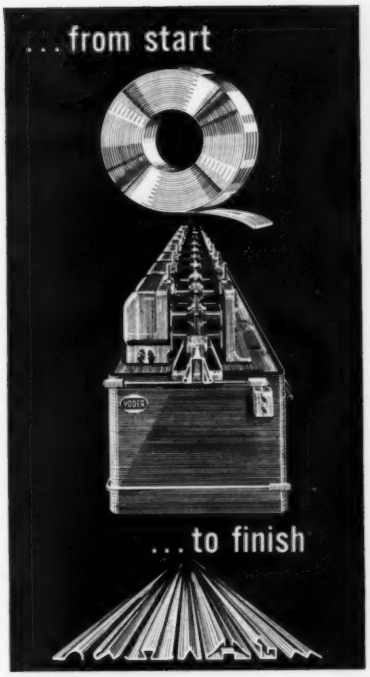
CIRCLE INFORM-A-GRAM KEY NO. 1112



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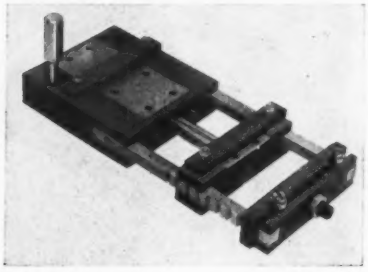
Product News

New Punch Press Feeds



Two new Rapid-Air Punch Press feeds are available from Mechanical Tool & Engineering Co. Model D-5 feeds stock up to 4″ wide with a 0″ to 5″ stroke and model F-6 feeds stock up to 6″ wide with a 0″ to 6″ stroke. Both feed rate and stroke length are adjustable. These feeds can be mounted on die set or bolster plate and can feed automatically from either side, front or back. For details on these and four other models write Mechanical Tool & Engineering Co., 2323 Twenty-Third Ave., Rockford, Ill., or Circle Inform-A-Gram No. P1.

Threaded Insert Kit

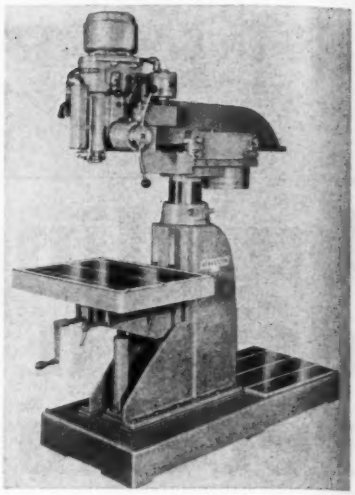
Stripped-out threads are easily replaced by threaded inserts with Hi-Shear's handy new insert tool kit. The self-locking threaded inserts are inserted in a drilled hole with a simple hand tool enclosed

in the kit with ten inserts. Get data from Hi-Shear Corp., 2600 W. 247th St., Torrance, Calif., or Circle Inform-A-Gram No. P3.

Reversible Drills

Three new portable electric drills in the Thor 1400 Speed Drill series now are available in reversible models. The special duty 1420-R ½″ drill, heavy duty 1435-R ½″ drill, and heavy duty 1440-R ⅝″ drill all have a built-in reversing switch on the handle to permit fast in-out operation in all types of drilling. For data, write Speedway Div'n, Thor Power Tool Co., 1421 Barnsdale Rd., LaGrange Park, Ill., or Circle Inform-A-Gram No. P4.

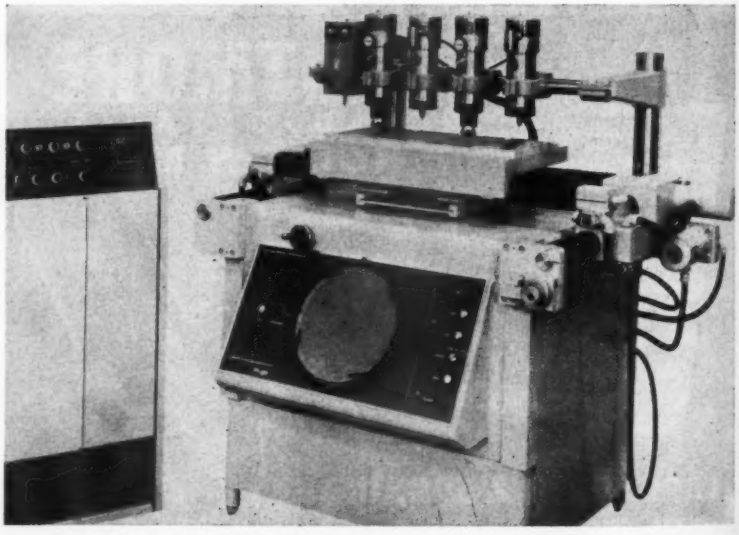
360° Rotation



The 3′ arm of this radial drilling machine rotates a full 360°, enabling movement of the drill head to any hole location on a workpiece up to 6′ dia, and more than 4′ high. Two work stations are accessible: one 20″ x 40″, which adjusts vertically through 16″, and a 22″ x 24″ rear platform. Both have accurately ground surfaces with finished T-slots and coolant troughs. Three models of this machine style have up to 1¾″ drill capacities in cast iron, and positive speeds in various ranges from 45 to 3000 rpm. Further information is available from I. O. Johansson Co., 7248 St. Louis Ave., Skokie, Ill., or Circle No. P5.

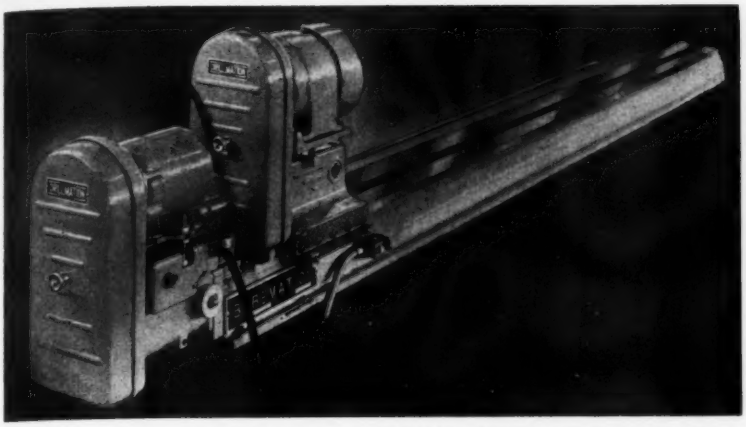
Circuit Board Driller

A new automatic high speed circuit board drilling machine is designed to increase hole-positioning accuracy to 0.001″. Using magnetic tape control, the MPI 440 unit can drill 40 holes/min with each drill head and 640 holes/min with four stacks of four boards each with an average positioning time of less than 1 sec. For more information, write Micro-Path Inc., 4949 West 104th St., Inglewood, Calif., or Circle Inform-A-Gram No. P2.



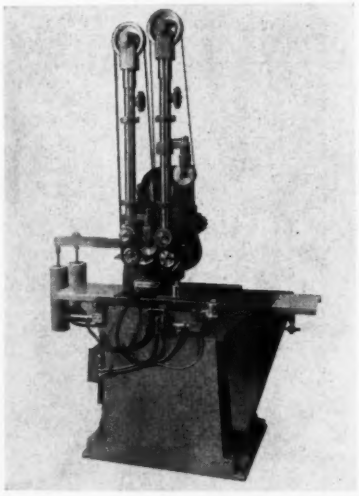
Product News

60" Gun Drill



Holes ranging up to 60" long and 3" dia can be gundrilled from the solid in one pass on the Boremation "Sixty," a new heavy duty gun drilling and boring power unit. Variable spindle speeds can be matched to any of the infinitely variable feed rates. For more information, write Drillmation Co., 6500 E. 11 Mile Rd., Center Line, Mich., or Circle Inform-A-Gram No. P7.

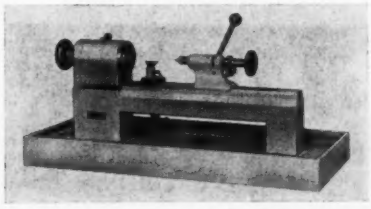
Cost Cutting Grinder



The new Loungway Rise & Fall abrasive belt grinder automatically rough grinds and finish grinds contour and form parts in one cycle in seconds. It comes with single or double-spindle assemblies, and other variations can be quickly adapted for handling special contours. The double-spindle model handles parts up to 4" x 6" long. For details, write Eastern Machine Screw Corp., 60 Barclay St., New Haven 6, Conn., or Circle No. P6.

Instrument Lathe

This new instrument lathe has a collet capacity of ½" and is for parts that are fairly large but require delicate operations. Spindle



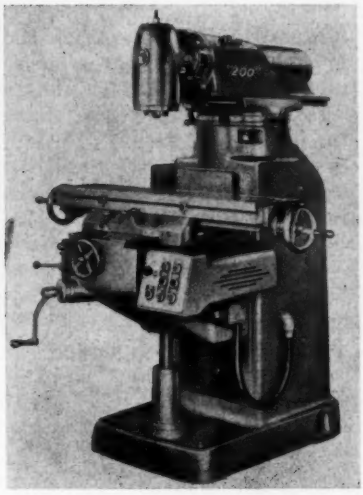
speeds range from 0 to 4000 rpm. A foot switch starts and stops the machine and controls an optional coolant pump. For data, write Louis Levin & Son, Inc., 3610 So. Broadway, Los Angeles 7, or Circle Inform-A-Gram No. P8.

Tracer Stylus Sets

Tracer stylus sets for 360° and 3D duplicating are available with round noses for ball end mill work or square noses for flat end mills. Each set contains 30 stylii in sizes from 0.125" dia to 1.062" dia. For more information, write for Bulletin TSS-1, True-Trace Corp., 9830 Rush St., El Monte, Calif., or Circle Inform-A-Gram No. P9.

Milling by the Numbers

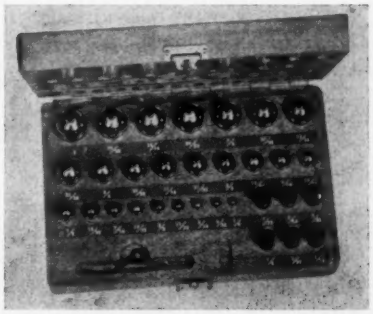
Numerical control guides slide movement in three axes on this new Famco 3-hp milling machine. Numerical data is taken from the design information and transferred



to the electro-hydraulic control system, eliminating positioning templates and tools, laying out cuts, hand gauging, and checking. Get more data on the unit from Famco Machine Co., Kenosha, Wis., or Circle Inform-A-Gram No. P10.

Precision Ball Set

Master balls made of tungsten carbide to ±0.000010" size tolerance, 0.000010" sphericity, and 1 micro-inch finish are used for simplified checking of hole depths,

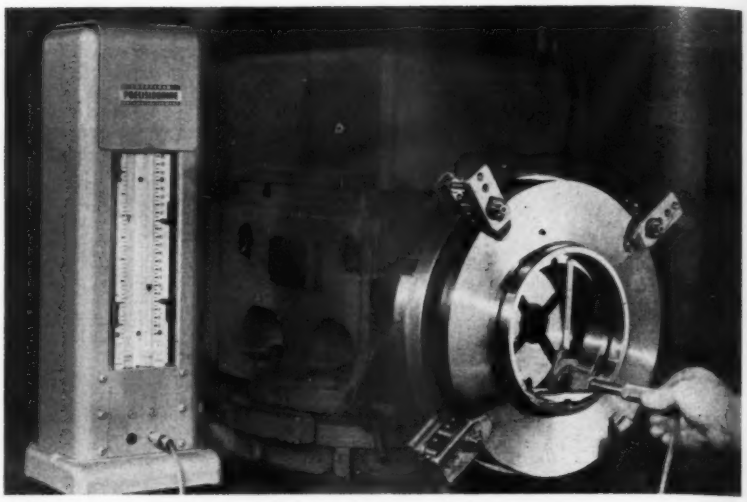


ID's and internal tapers, and other applications. They're available in sets or individually in 31 sizes. Ask for Bulletin P-41. Write Industrial Tectonics, Inc., Ball Div'n, 3686 Jackson Rd., Ann Arbor, Mich., or Circle No. P11.

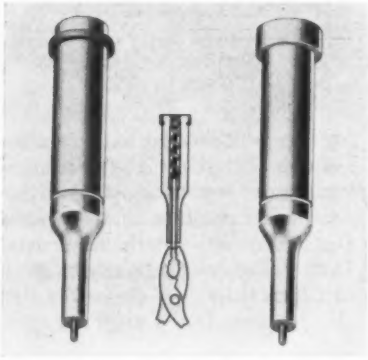
Product News

Precision Gage

The Dual-Amp Precisionaire gage combines low amplification long gaging range and high amplification close tolerance inspection in an automatic sequence. One column shows part size within the 0.018″ range and the other spreads the final 0.002″ over 4″. For more information, write The Sheffield Corp., Dayton 1, Ohio, or Circle Inform-A-Gram No. P12.

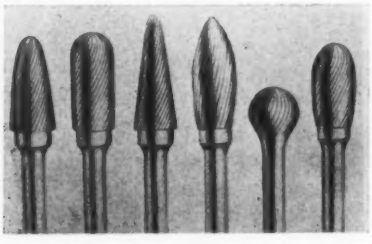


Punch Grinding Speeded



Grinding of punches is simplified with the new Pull-Pin Ejector punches. Disassembly of punches or removal of stripper plates is eliminated because the ejector pin is removed from the punch with pliers, the punch is sharpened, and the pin is simply pushed back in. For details, write Ring Punch & Die Div'n, The Producto Machine Co., Jamestown, N.Y., or Circle Inform-A-Gram No. P13.

Rotary Files Improved



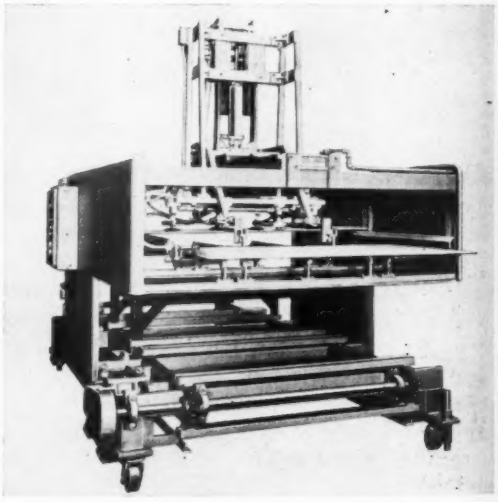
The best advantages of both sectional and center fluting are combined in the new Bi-Dex tungsten carbide rotary files to eliminate chatter and chip-clogging at the nose of the file. A special gradual beveling of every other tooth expands the open surface area between the flutes and aids chip removal. Get details from the Grobet File Co. of America, Carlstadt, N.J., or Circle Inform-A-Gram No. P14.

Corundum Abrasives

High quality surface finishes are obtained with the Centriforce line of abrasives. They contain carefully graded particles of corundum and are made in six grades from particle sizes of 5 to 22 microns. Get data from American Optical Co., Southbridge, Mass., or Circle Inform-A-Gram No. P15.

Destacker & Feeder

This automatic vacuum cup destacker will lift one sheet at a time from the top of a stack of blank sheets, index forward and deposit the sheet on the feed station. The lifter mechanism then returns and picks up another sheet. As this sheet is indexed forward to the feed station, pushers, attached to the lifter mechanism, push the previously loaded sheet from the feed station thru a double sheet detecting safety device into a punch press, shear, roller, roller leveler or roller applicator. This unit is completely self-contained, floor-mounted, and includes both automatic cycling and manual inching controls, as well as sheet separator. Details on its various sizes and arrangements may be had from Die & Automation, Inc., 5353 Dixie Highway, Hamilton, Ohio, or Circle Inform-A-Gram No. P16.



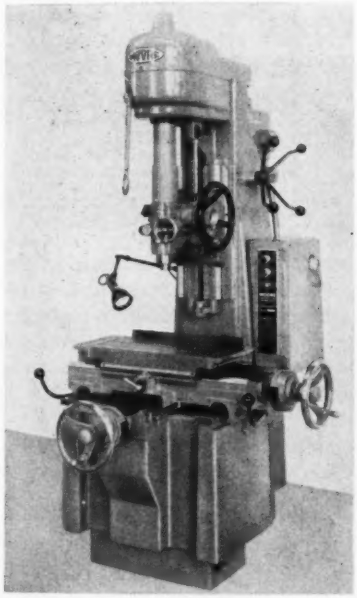
Product News

Smoother Gun Drilling

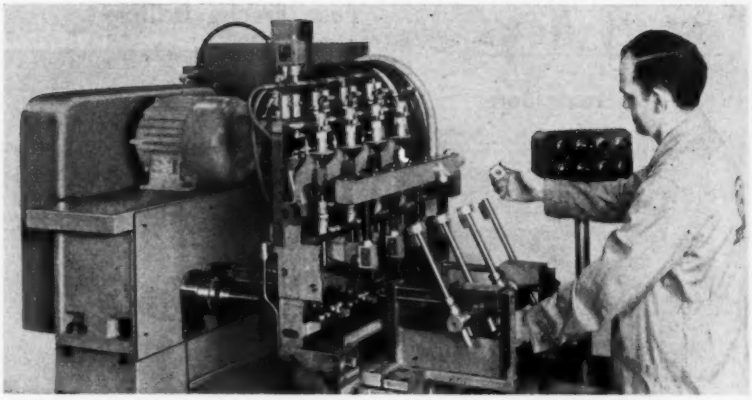
New helical fluted gun drills provide smoother operation and better balance at high spindle speeds. The target and center-cut

drills with Gun-Twist shanks are made by National Twist Drill and Tool Co., Rochester, Mich. They greatly reduce the vibration often encountered when conventional gun drills are run at high speeds. Write the company, or Circle Inform-A-Gram No. P17.

Jig Borer Splits Tenths



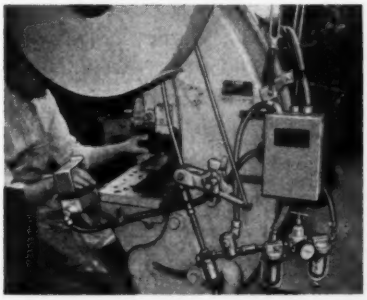
Designed for working to split-tenth tolerances, this new No. 1½ Moore jig borer has a 10½" x 19½" table and a special 3-position clutch for easy control by the operator. Highlights of the new design include closer tolerances, infinitely variable spindle speeds from 120 to 2400 rpm, and elimination of gibs and overhang. For more information, write Moore Special Tool Co., Inc., 800 Union Ave., Bridgeport 7, Conn., or Circle Inform-A-Gram No. P18.



Precision Boring

This standard single-end Ex-Cell-O precision boring machine will rough and finish the bores in aluminum die-cast valve rocker shaft bearings, four at a time in a total cycle of only 16 sec. In operation, parts are manually loaded and radially located on a ram type loader. The automatic cycle is initiated by the final movement of the loading mechanism. The table rapids to the left where both rough and finish boring is performed. Unloading is exceptionally rapid. As clamps are released, air pressure forces the workpieces from their positions and onto a conveyor which transports them to the rear of the machine while air jets clear chips from location pads. Full details available from Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 12, Mich., or Circle Inform-A-Gram No. P19.

Press Safety Controls



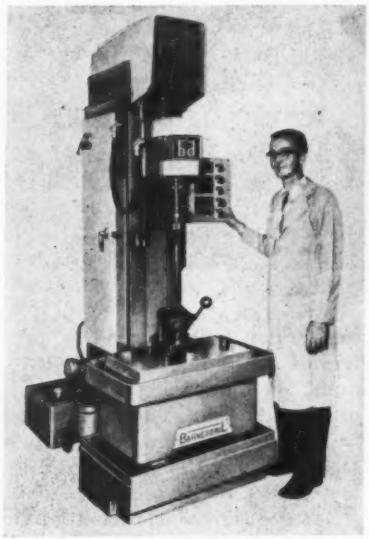
Searjeant Metal Products, Inc. has added to their line of power press controls. The two hand control circuit makes it impossible for the operator to tie one palm button down and trip the machine with the remaining palm button even for the first stroke. The control box is used to automate certain stamping and punching operations, it being a simple matter to attach actuating switches to certain dies and plug them into the control box in place of the palm buttons. Each time the operator feeds work into the die the stock will automatically actuate the switch and trip the press only when it is in the correct position. For additional information on these and other Searjeant controls, write Searjeant Metal Products, Inc., 37 Pittsford Rd., Mendon, N.Y., or Circle Inform-A-Gram No. P20.

Space-Saving Holder

Designed for tape controlled or automatic machines, the new Model RA recess toolholders have a 40% shorter working section without sacrificing any of the range. Patented gear-and-rack actuation reduces wear, and a ball bearing pilot provides precise location. For details, write Maxwell Industries, Inc., 493 E. 5th St., Ashtabula, Ohio, or Circle Inform-A-Gram No. P21.

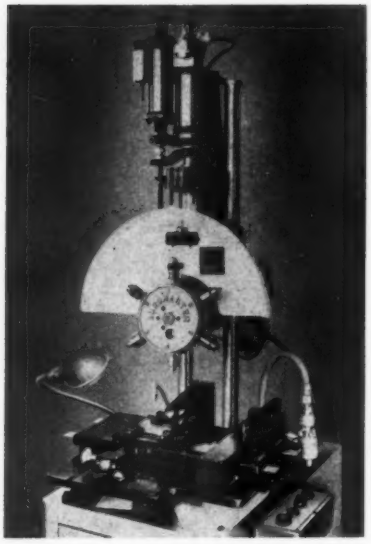
Product News

Honer for Small Bores



A new honing machine for small dia bores, made by Barnes Drill Co., 862 Chestnut St., Rockford, Ill., has a 12″ stroke, and 12″ swing. It hones bores up to 2″ dia at maximum stroke. A simplified electric hone expansion unit controls the infinite feed adjustment. For details, write the company, or Circle Inform-A-Gram No. P22.

Fast, Precise Drilling



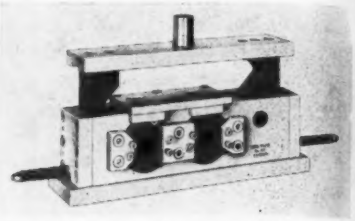
The new Burgmaster bench model automatic 6-spindle turret drill with power feed and manual positioning table eliminates box fixtures and jigs to speed precision drilling at lower tooling costs. Hole centers are rapidly located within 0.0005″ by the ball bearing mounted table. Operation can be manual, semi-automatic, or fully automatic. Write Burgmaster Corp., 15001 S. Figueroa St., Gardena, Calif., or Circle Inform-A-Gram No. P23.

Production Saw

The Continental Production Saw by DoAll is a compact, powerful machine for continuous cut-off work. It has a horizontal cutting head and cuts with the top saw band. The resulting compactness permits the use of new 2″ wide tungsten carbide - tipped saw bands, a 10 hp drive and 16″ x 20″ capacity yet the floor space and weight are small. New features of the Continental include electrically programmed stock indexing, micrometer length adjustment, automatic chip disposal, overhead mounting of main and outboard vises, servo regulated cutting rate, planetary chip brush and standardized worktables. For details write The DoAll Co., Des Plaines, Ill., or Circle Inform-A-Gram No. P24.

Faster Notching

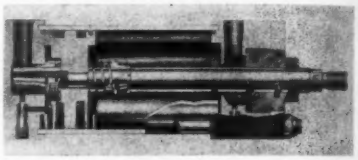
Two complete notched ends (four notchings) of pipe or tubing are made with one stroke of the punch press using the new No. 102



Arc-Twin Tandem. The unit shears from the inside out, cutting clean edges which require no further finishing and without deforming the work. Write Vogel Tool & Die Corp., 1825 N. 32nd St., Stone Park, Ill., or Circle Inform-A-Gram No. P25.

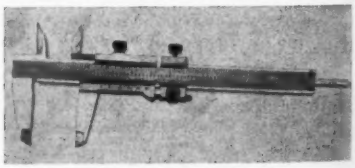
Square End Cylinders

The Square Head line of square end double-acting pneumatic and hydraulic cylinders have full floating cushions for rapid and smooth



advance and deceleration of the piston. Thirteen mounting styles are available, all dimensionally interchangeable with JIC standard square end cylinders. For data, write Mead Specialties Co., Dept. SH-93, 4114 North Knox Ave., Chicago 41, or Circle Inform-A-Gram No. P26.

Linear Vernier Caliper



The new #244 linear vernier caliper has a 6″ scale with effective measuring range of 5″. It reads in either 0.001″ or 1/128″ with an accuracy of 0.001″. Its double jaws permit convenient inside or outside measurement from the same scale. Write Titan Tool Supply Co., Box L, 1419 Hertel Ave., Buffalo 16, N.Y., or Circle No. P27.

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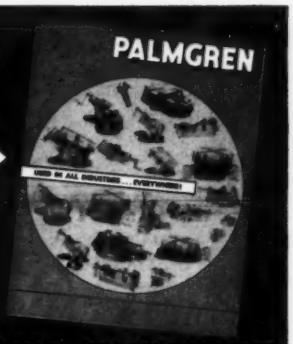
FREE CATALOG

ON WORK HOLDING TOOLS FOR PRODUCTION, TOOLING, MAINTENANCE



Drill press vises, angle vises, swivel machine vises, rotary tables, lathe milling attachments, production vises, heavy duty angle vises, and adjustable angle plates are illustrated and fully described in the New Palmgren Catalog. This is the only complete line of work holding devices available anywhere. Designed for production, tooling, and maintenance work, there are 68 different models and types to choose from. Vise jaw sizes are from 1½" to 8". Ask for your copy of this FREE Catalog No. 205 today. The complete line with details and prices are shown.

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by CHICAGO TOOL AND ENGINEERING CO.
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ELASTICONE® STEEL RIBBON **COVERS**

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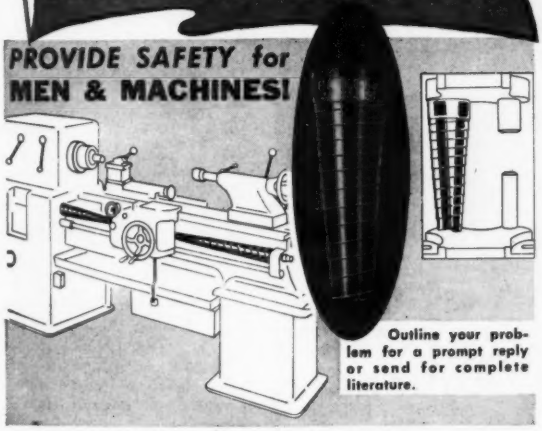

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Elasticones are metal-formed, cone shaped covers that open and close automatically to provide protection against dirt, damage, and catching of limbs, for all precision moving parts. Available in all finishes and sizes from ⅜" diameter up to 60" long.

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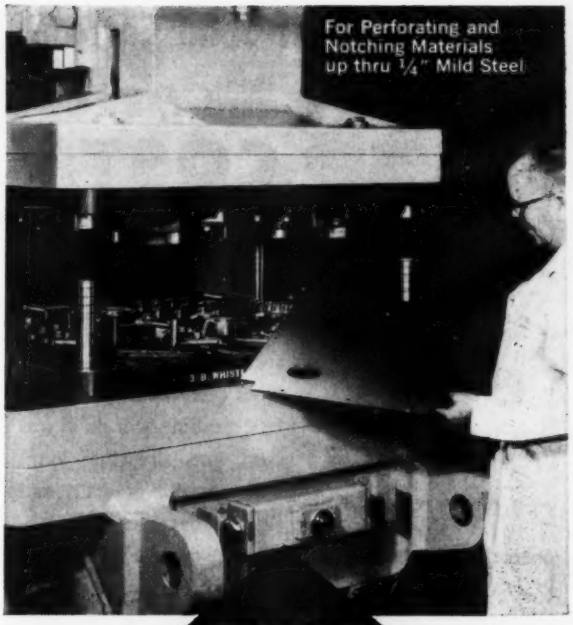

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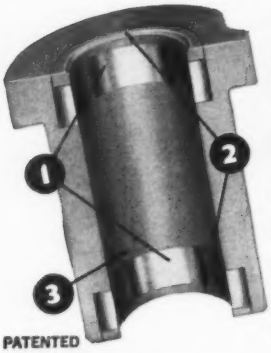
Does the job of Solid Carbide and MEYCO COSTS LESS!



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1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

There in a nut shell is the story of MEYCO carbide inserted drill jig bushings! Does everything a solid carbide bushing will do at less cost: lasts almost as long; increases life of drills and jigs; greater accuracy—longer; saves man-hours and machine down-time! All this spells high production at a lower cost. For over a decade, carbide inserted drill jig bushings have been saving money on long production runs for cost conscious customers.

Write for new Bushing Catalog No. 41

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- PORTABLE WORK TABLE

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Capacity.....2000 lbs.
Lift.....24" min. to 42" max.
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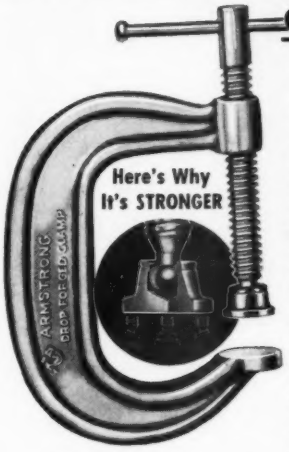
POSITIVE PERFORMANCE
Self-locking Acme screws hold load safely, securely, at any height.

COMPACT DESIGN
No projecting parts—all four sides accessible; crank studs at both ends; three table surfaces.

ECONOMY ENGINEERING 4509 W. Lake St., Chicago 24, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 1182

New ARMSTRONG Swivel Pad can't come off



NOW ARMSTRONG deep throat "C" Clamps have the new (Pat. apd. for) ARMSTRONG Ball-joint Swivel Pad. This "C" Clamp pad, developed by ARMSTRONG Engineers, is tougher than any on the market. Rigorous testing in our own plant first proved this fact, and field tests in factories throughout the country have confirmed our own test results.

The lip of the opening in the ARMSTRONG Ball-joint Swivel Pad is undercut so that when the ball of the screw is inserted, and the lip is permanently forced down, a solid steel wall is formed, inside the pad cavity, completely encircling the ball.

This wall of steel makes it impossible for the pad to come off the screw during normal use. In fact, our tests have proved that it is virtually impossible to intentionally knock the pad off with a hammer—yet the pad is free to swivel through an arc of approximately 40°.

Call your ARMSTRONG Distributor

Your ARMSTRONG Distributor can offer delivery from stock on this "400-Series" deep throat, drop-forged "C" Clamp with the new Ball-joint Swivel Pad. He also carries in stock the other styles of clamps in the ARMSTRONG Line—the broadest line of drop forged "C" Clamps.

ARMSTRONG BROS. TOOL CO., 5220 W. Armstrong Ave. Chicago 46, Illinois

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Now ready:

Manual of Machinability and Tool Evaluation

by ANTONI NIEDZWIEDZKI
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TYPICAL CHAPTER COVERAGE: Tool Life Formulas . . . Tool Life Criterion . . . Chip Load and Workpiece Hardness . . . Tool Geometry . . . Test Records . . . Tool Inspection . . . Machinability Classification . . . Machine Tool Selection.

The Manual contains a wealth of examples and forms for Development Sheets . . . Recommendation Sheets . . . Crossed Charts . . . Tool Life Tables . . . Graphs and Drawings . . . covering work with Carbides and HSS on Cast Iron and Steel.

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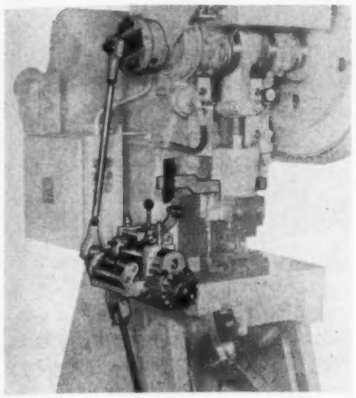
Product News

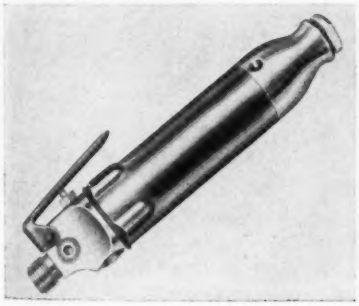
Roll Feeds

Designed specifically for high speed punch press automatic operation these feeds are ruggedly constructed throughout with roller or ball bearings used for all rotating parts. A unique feature



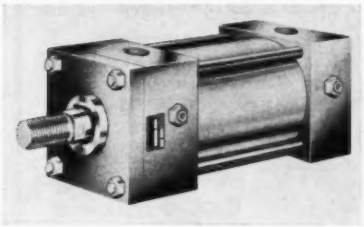
is the high speed disc type brake that has double the usual braking area. These roll feeds mount directly on the press bolster to feed from either side, front or back. They are available in fourteen sizes with maximum feed lengths ranging from 2½" to 12" and a variety of stock widths from 4" to 12". Detailed information from Cooper Weymouth, Inc., 600 Honeyspot Rd., Stratford, Conn., or Circle Inform-A-Gram No. P28.

Pneumatic Grinder



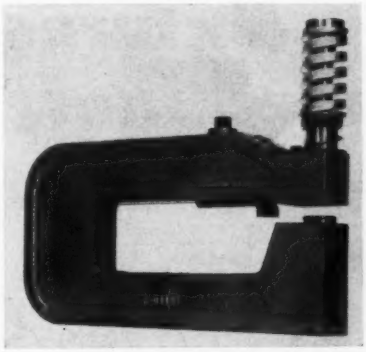
This lightweight cyclone pneumatic grinder operates at 50,000 rpm and accommodates ¼" dia mandrels. An adjusting screw controls a valve to regulate spindle speed for varying air pressures. Get details on the Model 60 from M-B Products, Inc., 46 Victor Ave., Detroit 3, or Circle Inform-A-Gram No. P29.

Air and Fluid Cylinders



The newly improved S-P Series A cylinders offer an added economy in that they can be used without any modification in either air or hydraulic systems. S-P engineers have designed an interchangeable cylinder that can be used for all types of industrial applications at pressures up to 200 psi air and 500 psi oil or water. Built to major automotive manufacturers' and JIC standards, S-P's new cylinders are available in 21 different mounting styles and eleven bore sizes from 1½" through 14", with strokes to user's specifications. Piston seals are removable cartridge-retained rod seals are rated for operation at temps from −20 to 150°F. Complete information may be obtained by writing the S-P Manufacturing Corp., 30201 Aurora Rd., Cleveland 39, or Circle Inform-A-Gram No. P30.

Universal Stops



A new and complete line of stops for use with their Series "A" and "B" Unipunch tools has been developed by Punch Products Corp. Included is the stop shown here in close gaging position. Turning stop around permits gaging in extended position, while front to back adjustment is provided by sliding stop along slot in top of holder. For details on the entire new line write Punch Products Corp., 370 Babcock St., Buffalo 6, N.Y., or Circle No. P31.

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HAND WHEELS
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SPECIALS
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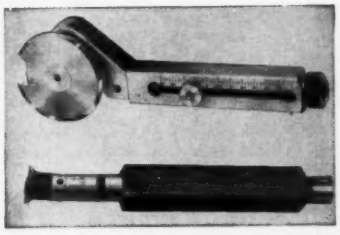
THREAD
Cutting Tool



Provided with a scale for angular setting.

Circular Cutter, in high speed or carbide, has a negative profile and machines both thread flanks simultaneously. Thread cutting discs for all threads are available for both external and internal tool holders.

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71 West Broadway,
New York 7, N. Y.

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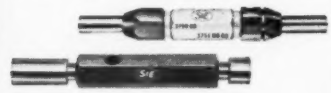
✓repetitive accuracy to work with...

S&E solid carbide gages will remain true to size longer—up to 50 times longer than steel gages. You'll **know** you are **correct to size** and continue to be . . . long after you have saved the cost, over and over again, of an S&E gage.

S&E gagemakers work with the finest gagemaking equipment and materials, under controlled atmospheric conditions — producing the optimum in gage accuracy and economy. Place an order now—you'll be glad you did.

Cylindrical Plug Gages
tri-lock—taper lock—progressive—reversible



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Master Setting Discs

S&E "Thrifty" Gage

tolerance classes: xx-x-y-z
special tolerances available

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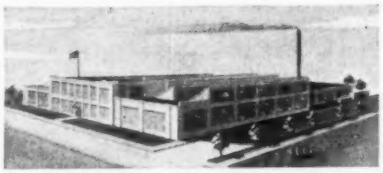


COLUMBUS DIE-TOOL & MACHINE CO.
P. O. BOX 750 • COLUMBUS, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1202

Product News

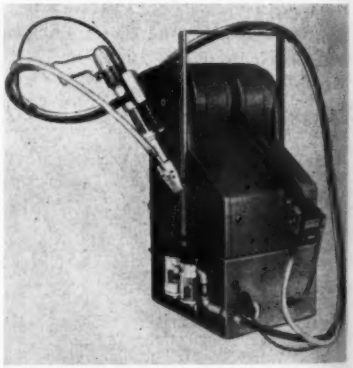
Impact Wrench

This 4½ lb air-powered reversible impact wrench permits rapid tightening of threaded fasteners to high torques with maximum

comfort. The 34J wrench has a 3-lug impacting mechanism which provides 3 impacts/rev and evenly distributes the impacting force over 3 wear surfaces, providing longer life. For details, write Buckeye Tools Corp., 5003 Springboro Pike, Dayton 1, Ohio, or Circle Inform-A-Gram No. P32.

Automatic Screwdriver System

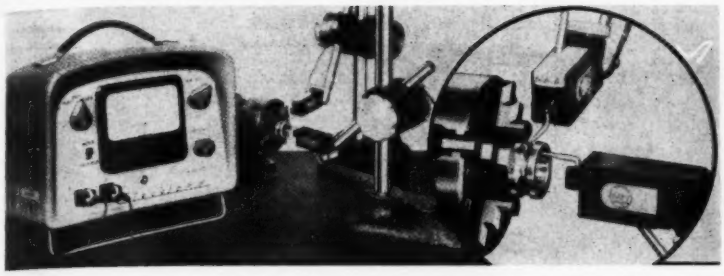
New automatic equipment which sorts, meters, and installs all types of screws, pins, bolts, rivets, and studs at rates up to 7000/hr, has



been developed by Clyde Engineering and Mfg. Corp., 937 E. 10 Mile Rd., Madison Heights, Mich. The Tru-Tork automatic screwdriver system consists of a compact hopper unit with positive electrical switch-controlled feed and a standard power screwdriver. The pneumatically fed screwdriver is equipped with a self-centering bit and clamping tip. For details, write the company, or Circle Inform-A-Gram No. P33.

Product News

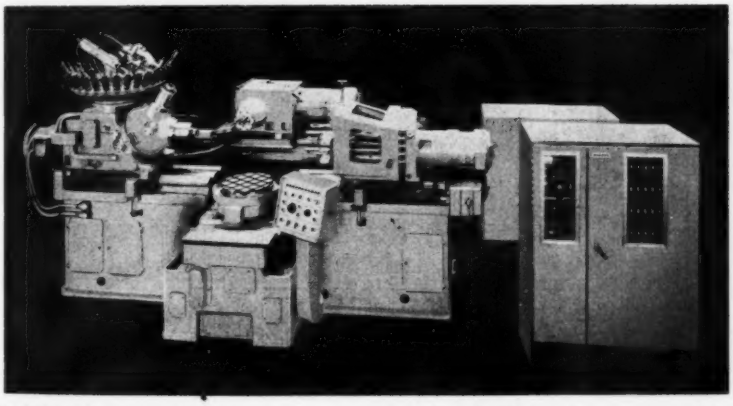
Simple Gaging Equipment



Eliminate mechanical fixturing in your gaging work by using this simple electronic gaging equipment. Typical applications include measurement of true roundness of journals on parts weighing up to four tons while in the production machine, and concentricity of ID and OD of small bearings using non-precision spindles. Basic equipment consists of two gage heads and a differential input amplifier, and can handle such other gaging work as cam contour and lead screw pitch. Get more data from Cleveland Instrument Co., 6220 E. Schaaf Rd., Cleveland 31, Ohio, or circle No. P34.

Paired Cylinders

These Model BT tandem cylinders feature two pistons mounted on a common rod and are intended to provide the advantages of hydraulic control to an air operated cylinder. The hydraulic fluid can be used either in the front cylinder or in the center section of the unit without a makeup chamber. For details, write Allenair Corp., 255 E. 2nd St., Mineola, N.Y., or Circle Inform-A-Gram No. P35.



Quick Change Artistry

A central positioning table is surrounded by three tape-controlled work heads on this new unit: a universal drilling, tapping and boring head featuring storage for 30 tools and tool-changing time of three seconds, a face milling head, and an optional multiple spindle drill head or a precision boring head with a 14 tool capacity changer. Work is positioned in relation to cutters in increments of 0.001" to an accuracy of ±0.0005". Get more data on the MT-3 Machining Center from Hughes Aircraft Co., Industrial Systems Div., Box 90904, Airport Station, Los Angeles 45, Calif., or circle Inform-A-Gram No. P36.

MAGNETIC BASE INDICATOR HOLDER

¼" dia. non-magnetic stainless steel rod complete with 5/16" and ⅜" O.D. bushings. Fine precision adjustment identical to surface gage. Hardened ball socket setting permits universal positioning. Powerful 50-lb. pull magnetic base insures firm grip on any ferrous surfaces curved or flat.

Model 200B—Price $6.95

Write for Catalogue #958

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Large Precision Machining
Done to your specifications
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FAST • SAFE • BETTER
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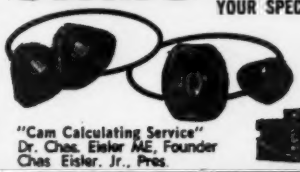

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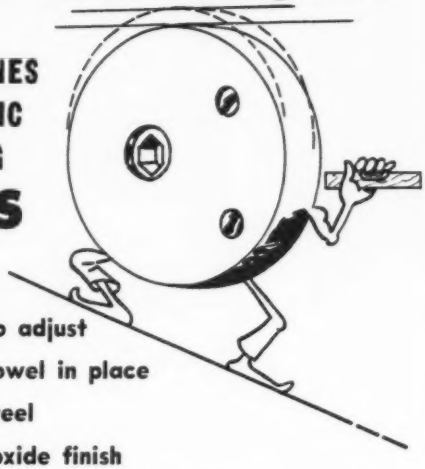
CARR-LANES ECCENTRIC LEVELING **LUGS**



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COIL WEIGHT AND LENGTH CALCULATOR

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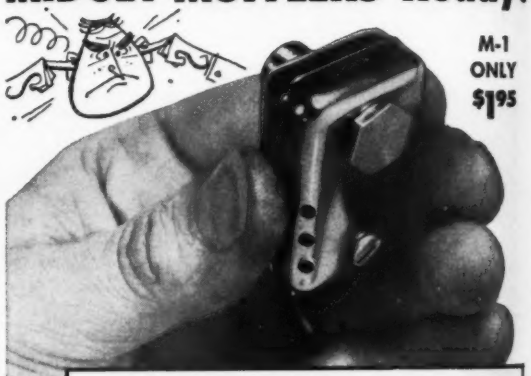

M-1 ONLY $1.95

Sensational!

Industry's handiest new devices! They're made from polyether foam enclosed in anodized aluminum — they silence noises caused by exhausting air. Rust-proof; common solvents clean 'em! Use M-1 or 2 for 1/8" or 1/4" exhaust ports; M-3 for 3/8" port. Order your Mead Midget Mufflers direct or send for name of nearest Mead Distributor.

M-2 $1.95

M-3 $2.50

Prices slightly higher West and Canada

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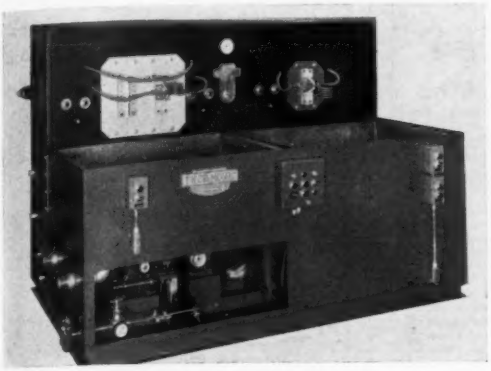
CIRCLE INFORM-A-GRAM KEY NO. 1224

Product News

New Induction Unit



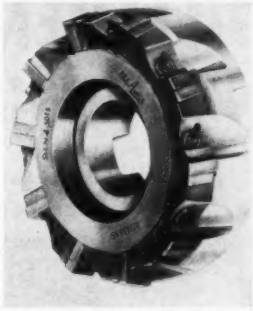
Low or high frequency hardening operations can be done on this new Ther-Monic unit equipped with a 3-position work station. It has dual facilities for oil and water quenches and can be used as a reservoir for both oil or water recirculating systems or drop quench systems. Write Dept. PR-16, Induction Heating Corp., 181 Wythe Ave., Brooklyn 11, N.Y., or Circle No. P38.

3-in-1 Boring Tool

Rough, semi-finish, and finish boring are done with the Kwik-Size boring head, a 3-in-1 tool which can be indexed from one cutter to the next without disturbing the workpiece or removing the arbor from the machine spindle. It's mounted on an eccentric arbor so the unused cutters are clear of the bore. Davis Div'n, Giddings & Lewis Machine Tool Co., Fond du Lac, Wisc., or Circle Inform-A-Gram No. P37.

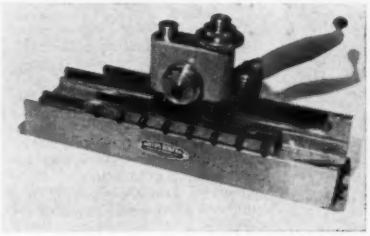
Dex-A-Mills For Throwaways

The Dex-A-Mill new line of face and shell end milling cutters is especially developed to extend carbide insert life, remove more metal/cutting edge, and to produce exceptionally fine finishes. The inserts are easily locked, unlocked, indexed or replaced with the cutter in position on the machine. Dex-A-Mill right and left hand cutters are available in face mill and shell end mill designs, with double negative rake angles and 15° lead angle in standard size diameters from 3″ to 12″; and also in larger



diameters as "specials." For complete information write Adamas Carbide Corp., Kenilworth, N.J., or Circle Inform-A-Gram No. P39.

Precision Marking Unit



This new precision machine is for the graduation and marking of all circular graduated machine tool dials, micrometer spindles, and other precision parts up to 6″ dia. A quick, accurate setup can be made for any cylinder requirement because the height of the spindle is quickly and accurately adjusted. Contact the Dayton Rogers Mfg. Co., 2824 13th Ave. S., Minneapolis 7, Minn., or Circle Inform-A-Gram No. P40.

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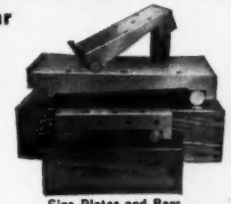

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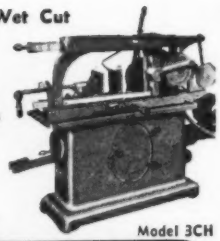

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New. Revolutionary double-box Headstock (Pat. Pend.)
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New. Amazing LOW PRICE.

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Different. Spindle rigidly held in two large "Zero Precision tapered roller bearings arranged in box-type design.
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Different. Cam-action tailstock clamp for rapid release and instant locking of tailstock.
Different. Triple, cogged, V-belt outboard drive—eliminates intermediate shafts—delivers more power to spindle.

This is an all new lathe that bridges the gap between conventional belt driven and geared head lathes. It combines the capacity and power of a geared head with the economy and flexibility of a belt driven lathe. Available with 5', 6' and 8' bed lengths providing 31", 42" and 66" center distances.

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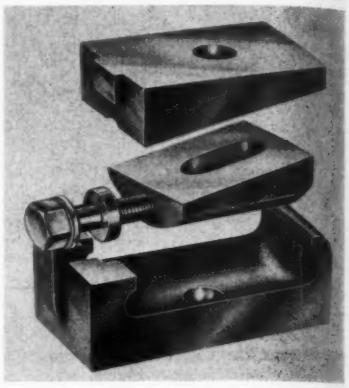
Product News

New Leveling Jacks

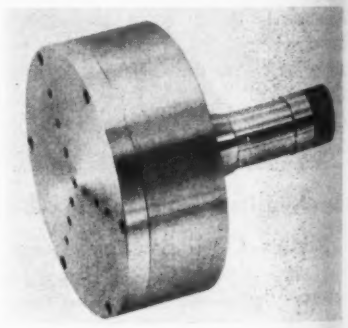
The new Empco Style J-H series of adjustable leveling jacks is for installation of machine tools, automation lines and other toolroom and production equipment. Of un-



usually compact design, the new units permit up to ¼" vertical adjustment and feature two interacting inclined planes which give smooth upward or downward control without lateral movement. For more information, write Enterprise Machine-Parts Corp., 2732 Jerome, Detroit 12, or Circle Inform-A-Gram No. P41.

Vacuum Collet Chucks

Parts are held for machining, grinding and inspecting with these new vacuum collet chucks. Their average holding power is 12 psi



with minimum distortion even on thin parts. A high-speed rotary union for speeds to 2500 rpm can be coupled with a special vacuum valve to permit use of the collet without stopping the spindle. Write The Dunham Tool Co., Inc., P.O. Box 18, New Fairfield, Conn., or Circle Inform-A-Gram No. P42.

"CUT milling down-time by 1600%"

Ford Solid Carbide End Mills — Frequent and expensive delays for end mill resharpening are a thing of the past when you use FORD SOLID CARBIDE END MILLS. In actual on-the-job comparisons, FORD tools have been in operation 16 times longer between regrinds than H.S.S. End Mills. Precision-ground by FORD, with extra long flutes, these end mills cut faster and produce a finer finish. Available in 11 standard types or in special models designed and produced to your milling requirements by FORD tool experts.

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Rotary FORD Tools

M. A. FORD MFG. CO., INC. Dept. TP-1160
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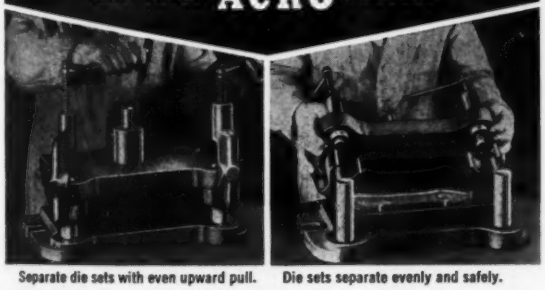
Manufacturers of Precision Cutting Tools

CIRCLE INFORM-A-GRAM KEY NO. 1251

FOR EASY, FAST UNIFORM SEPARATION OF DIE SETS...
USE THESE **ACRO** PULLERS



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When you have die set pullers that remove the punch holder from the die shoe by a straight upward pull and the punch holder slides upward from the die shoe simultaneously and safely from both leader pins, you have Acro Die Set Pullers and you're saving time.

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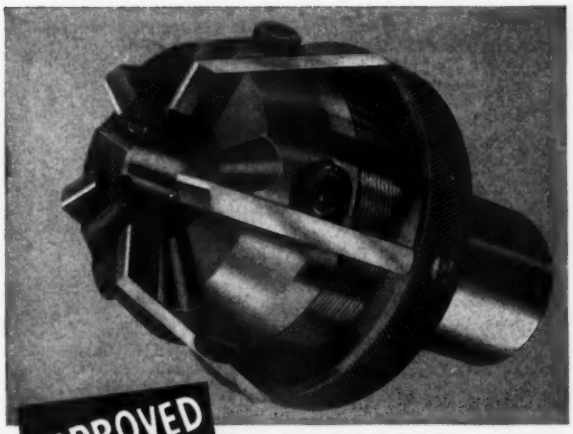
OTHER* ACRO *TIME SAVERS FOR YOUR SHOP include Acroflex, drill rod racks, leader pin oilers and wing nuts. Write for complete descriptive folder. Ask for bulletin TP59.

ACRO METAL STAMPING COMPANY
3387 E. Reservoir Ave., Milwaukee, Wis.

CIRCLE INFORM-A-GRAM KEY NO. 1252



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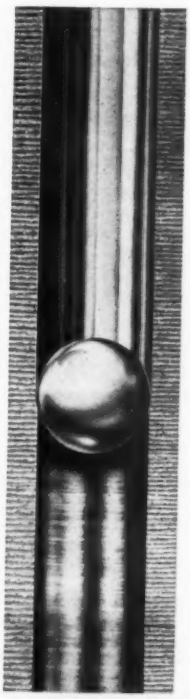

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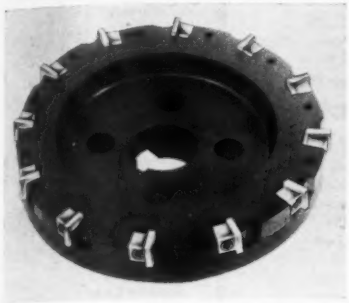
CIRCLE INFORM-A-GRAM KEY NO. 1262

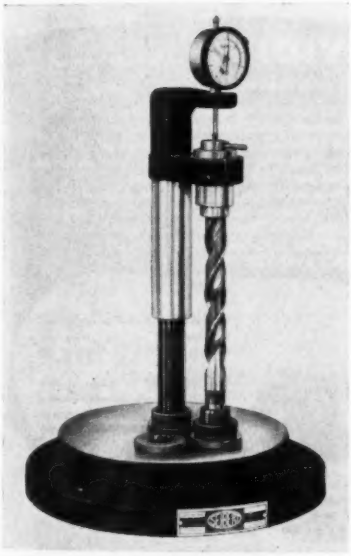
Product News

New Milling Cutters



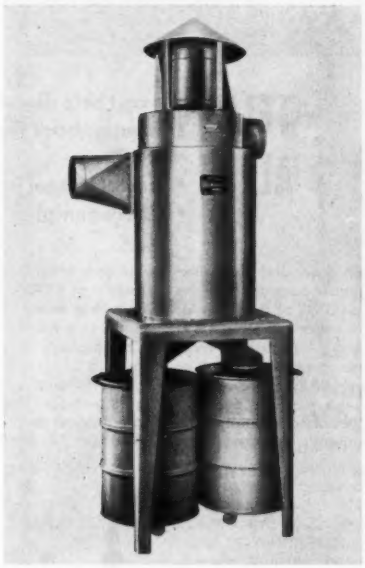
Standard milling cutters with indexable carbide inserts are available in a new complete line. The inserts may be quickly unclamped, indexed 90°, and reset, providing eight tip changes/insert. Two-piece construction of the cutter body permits precision grinding of the insert seats during manufacture, assuring perfect alignment. Contact Wetmore Tool & Engineering Co., 5320 E. Washington Blvd., Los Angeles 22, or Circle No. P43.

Compact Gage Plates



These new compact circular gage plates are supplied with from one to six holes. A six-hole plate is only 11½" dia. Gages furnished with the plates have hardened interchangeable heads and are made in bar height, chamfer, flush pin, and flush pin with indicator. Write Seibert & Sons, Inc., Chenoa, Ill., or Circle Inform-A-Gram No. P44.

Dust Removal Unit



A direct driven, self cleaning fan unit is a feature of the new DK-1055 cyclone type Duskolector. Its regular inlet size is 10" dia and multiple inlets are available for ducts to a number of dust sources. Ask for Catalog DK-820, available from Hammond Machinery Builders, Inc., 1631 Douglas Ave., Kalamazoo, Mich., or Circle Inform-A-Gram No. P45.

Carbide Sizing Balls

Burnishing and sizing of 1½" dia cylinder bores in aluminum alloy forgings were bettered in quality, quantity, and cost following a change from high speed steel to hard carbide sizing balls in a specially designed machine in a West Coast plant. Carbide balls had served 75 times longer than steel balls at last report and were good for still longer life. The aluminum forgings are held in a hard carbide die or "well" to maintain the outside dia while a hydraulic ram forces the ball through a 5" long bore. A single ball with close dimensional tolerances produces a 1.493"-1.494" bore size and imparts a burnished finish. The special machine operates with four identical balls cycling in a closed circuit. Production is 375 pcs/hr sized and burnished — 9000 every 24 hrs. The lubricant is a soluble oil thinned with kerosene. Complete information on carbide sizing balls from Kennametal Inc., Latrobe, Pa., or Circle No. P46.

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with interchangeable expansion plugs to gage simple or special holes to a fraction of .0001".

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1 set-up—
1 operation—
instead of 2!

Burr-Bit by Vernon Devices is made of the finest quality high speed tool steel. It fits all 2, 3 and 4 flute taps, and can be used on almost any material.

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Accurate, Heavy Duty

Ball bearing thrust on worm shaft and rear end of spindle.
Headstock spindle has threaded nose.
Large tapered bearing adjustable for end play. Head tilts past 90°.
Worm wheel and alloy stress-proof steel worm cuts to close limits for accuracy
Worm wheel and worm shaft can be fully disengaged.
Complete with three index plates for dividing all numbers to 50 and even numbers to 100 except 96T. Index chart shows all divisions obtainable to 380. Specify left (illustrated) or right hand model.
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MODEL SD 6½" Swing. Spindle threaded 1½"-8. ¾" table slot tongues. 36 lbs. **$175.00**

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MODEL AU 11" Swing. Fully universal for complete indexing and spiral cutting. Spindle threaded 2¼"-10. ⅝" table slot tongues. 190 lbs. **$460.00**

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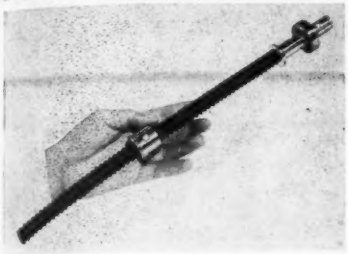
72 S. St. Clair St.,
Toledo 4, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1283

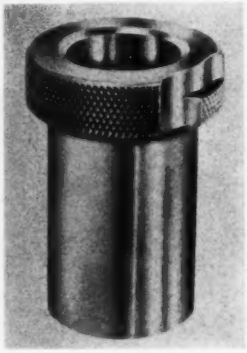
Product News

Anti-Friction Screw

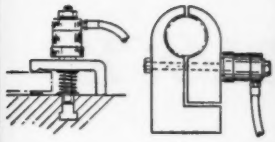


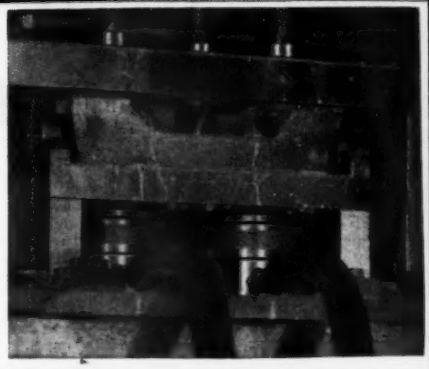
A new anti-friction screw with only four threads/inch will hold any elevated load such as a grinding head, chuck, or jack without slipping or counter-rotating. A non-recirculating ball screw assembly prevents counter-rotating of the screw and the small number of threads permits more rapid positioning of the load and lessens operator fatigue. For data, write R.C.S. Tool Co., 13861 Van Owen St., Van Nuys, Calif., or Circle Inform-A-Gram No. P47.

Graph-Mo Bushings



A new line of drill jig bushings manufactured of Graph-Mo developed by Timken Roller Bearing Co. is now available from Acme Industrial Co. in all popular sizes in a range to ⅞" ID. Graph-Mo, developed by Timken Roller Bearing Co., is an oil hardening, non-deforming type of tool steel. A carefully controlled chemical composition makes possible the precipitation of graphite from the total carbon content during mill processing. Special forging, rolling and furnace equipment produce the Graph-Mo to retain its unusually high anti-frictional properties. For detailed information write Acme Industrial Co., 200 N. Laflin, Chicago 7, or Circle No. P48.





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RISER BLOCKS

for FASTER-

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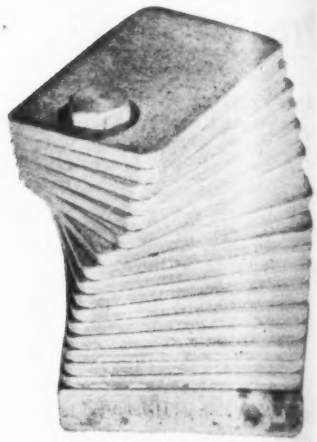

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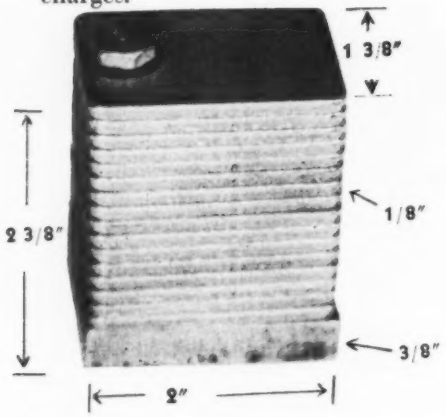
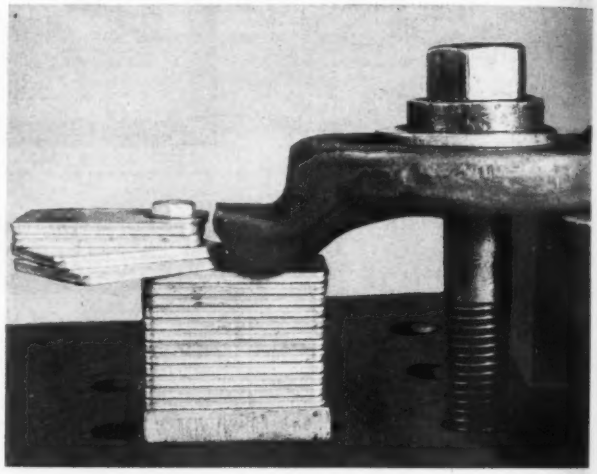
- Cut setup time by eliminating haphazard blocking.
- $5.00 per pair, plus transportation charges.





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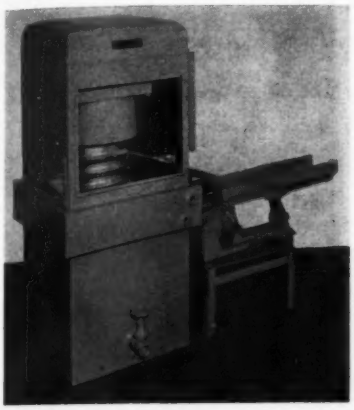
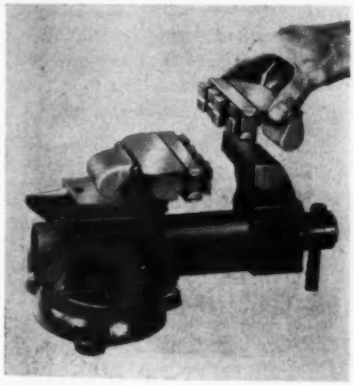
Product News

Compact Degreaser

The Vibra-Bantam is a new, small, low-cost subsonic degreaser. It features high production automatic in-line cleaning for all small parts, and utilizes a unique vibrating spiral elevator to move the work rapidly through non-flammable cleaning solvents and vapors, thereby eliminating tote pans and baskets. The Vibra-Bantam will process the full capacity of any screw machine, cold header or punch press and is available with either steam or electric heat. Chips are automatically separated and clean dry parts continuously emerge ready for inspection. Details from Manpro Corp., 1460 Hilton Rd., Detroit 20, Mich., or Circle Inform-A-Gram No. P49.



Grips for Odd Shapes

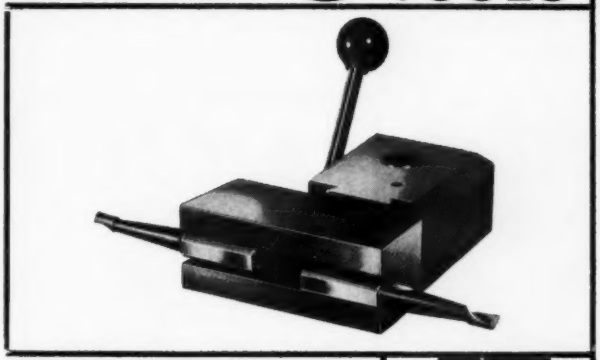


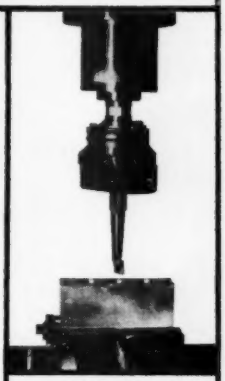
Machine vises can be instantly converted into universal vises to grip and clamp round, angular and irregular shapes. Uni-Grip auxiliary vise jaws make this possible because they have a series of case-hardened steel wedges, that automatically conform to irregular shapes when the vise is closed. Free-swinging counter balances hold the jaws in place without screws or clamps. Write Mid-America Import Co., Inc., 1919 Champa St., Denver 2, Colo., or Circle Inform-A-Gram No. P50.

Compact Power Unit

This compact air motor develops 1.5 hp in a unit 12″ long and 3¼″ in dia. The Model 71J-5 is adjustable to a variety of mountings and is especially suited for continuous operation in applications requiring quick starting and stopping. Get details from Gardner-Denver Co., Quincy, Ill., or Circle Inform-A-Gram No. P51.

VERSATILE LIDO BORING TOOLS*





LIDO boring tools can be simply and effectively mounted in tool holders for lathe use (above) or clamped equally as simply in offset boring heads (right) due to the parallel flat design of shank. Round shank with parallel flats makes positive three-point contact and permits new rigidity in tool clamping. Set-up and grinding time is drastically reduced. LIDO tools are re-sharpened as easily as grinding a single point lathe tool. Available in tool room sets — carbide or HSS — in bore sizes ranging from ⅛" to 1¼" (stubby or standard bore length) in five shank sizes. **Prices and complete data provided promptly on request!**

LIDO'S THREE POINT CLAMPING* *(below, right)*

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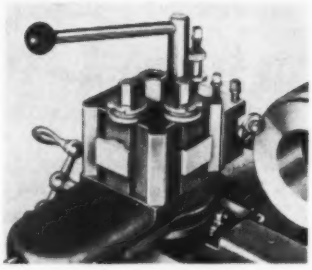

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Jets and missile vehicles are for the most part made of glamor materials, but usually of a different glamor than that associated with the word. But glamor actually applies to the plating use on "steering jets" for advanced space vehicles to fight off cosmic bombardment. Jets called thrust controllers, manufactured by the Bendix-Pacific Division of The Bendix Corporation, are plated with gold because of its reflectivity and density.

These hand-size electro-pneumatic controllers were first developed for the Discoverer satellite series. They keep space vehicles from tumbling and spinning by automatically providing correction.

The 99.8% pure gold plate is only 0.000040" thick and yet this unusual thin coat will reflect 95% of all energy radiation which might otherwise strike the gear.

During the coating process these controllers are first sprayed with a thin coat of epoxy and then placed in a near-vacuum chamber. The gold is heated to 4,712°F at which temperature it vaporizes and spreads throughout the chamber atmosphere to plate the controller. The cycle is completed after a 30 min bake in an oven.

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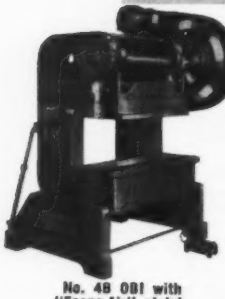
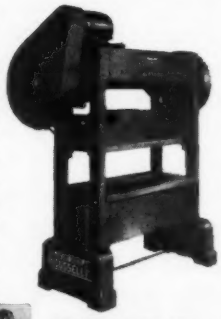


No. 4B OBI with "Econo-Air" clutch.

SPEED UP PRODUCTION with these versatile 40-ton presses. Large bed and ram areas make them ideally suited to handle wide rolls or sheets . . . do multiple punching, steel-rule die work and other high output operations. For rapid, shockless starting and stopping, presses can be equipped with electrically controlled "Econo-Air" friction clutch . . . Ask for new catalog.



STRAIGHT SIDE – Die space up to 24 in.; bed space up to 6 ft. between uprights.

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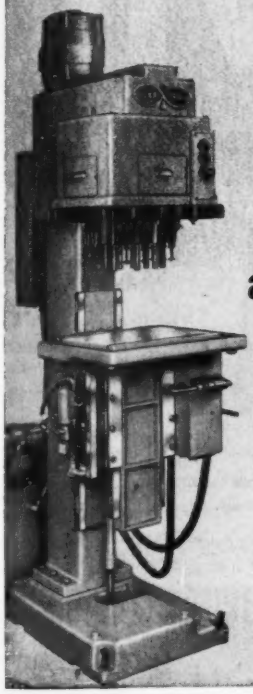
DEKA DRILL

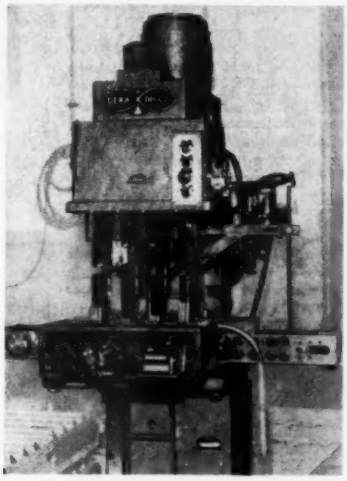
HYDRAULIC MULTIPLE SPINDLE DRILLING and TAPPING MACHINE



Send us one of your drilling or tapping problems for a free time study estimate. Find out how automatic cycle drilling and tapping with DEKA-DRILL can increase production and save time and money for **you!**

DEKA-DRILL CHAMFERS VARYING SIZED PARTS TO UNIFORM DEPTH!

COMPANY: Herschel Mfg. Co., Peoria, Illinois



OPERATION: Countersinking holes to uniform depth for subsequent riveting operation.

PRODUCTION: 2500 pieces per hour.

TECHNIQUE: Deka-Drill is fitted with adjustable dwell control to hold table at depth of stroke for ½ second. An air operated rack and shuttle feed inserts four pieces SAE 1095 25-30 Rockwell "C" into fixture simultaneously. A .228 hole, .100 deep at 60° including angle to .320 width is countersunk at 325 RPM. Machined pieces are automatically ejected by air onto conveyor.

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Here's a compact, convertible band saw that provides the capacity you've been looking for . . . at a modest price. Equipped with optional wheel handle unit, the Model 58-B becomes completely mobile . . . easily rolls from job to job. Use the 58-B as a horizontal cut-off machine (capacity: 6" x 10") or swing the head to upright position, install work table and it's a utility vertical band saw. See your Wells Distributor or write for Bulletin 262.

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finishes under 10 microinches!

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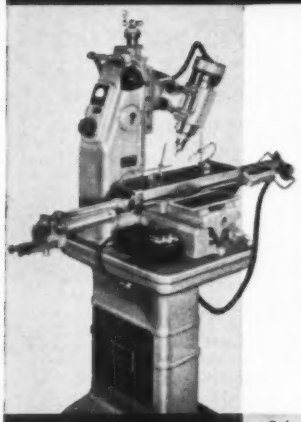

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4. Exclusive "Tru-Grip" tap holder for "close-to-wall" work

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Roll Barrel System shown above, for example, includes Multi-Roll "36", Multi-Roll "78", time-saving loading cabinet, and easy-to-use hoist boom. Nine different barrel sizes provide wide range of speeds and capacities. Using only one barrel or many, one man operates entire system.

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CIRCLE INFORM-A-GRAM KEY NO. 1344

Heavy Sections Joined In One Pass

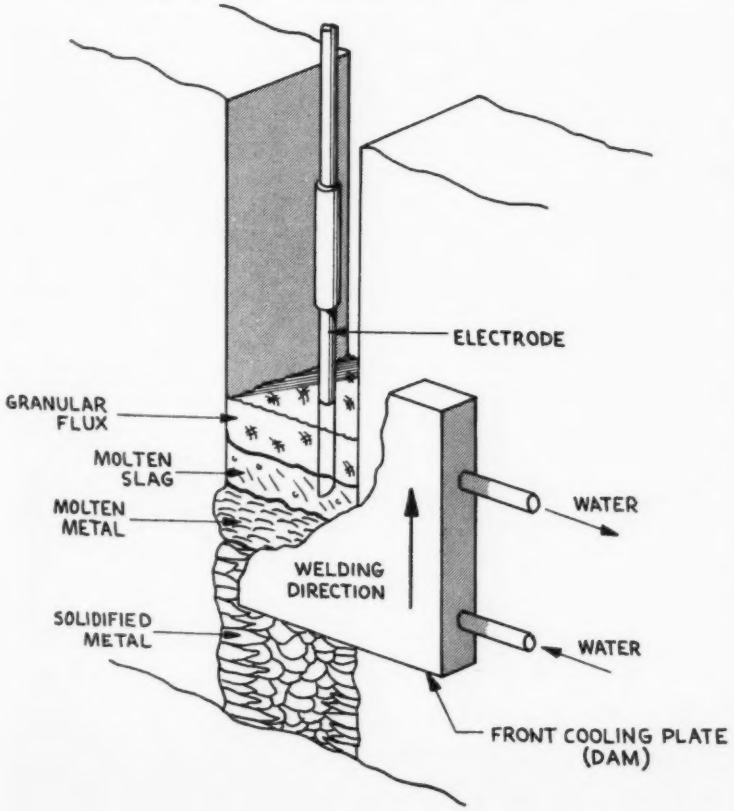
Small wrought shapes, castings, and forgings can be economically fabricated into heavy equipment with a relatively new European joining process, now being used in this country. It's known as electroslag welding and has been used to join steel sections up to 40" thick in a single pass without the need of joint preparation. In a report for the Department of Defense-supported Defense Metals Information Center at Battelle Memorial Institute, P. J. Rieppel describes the process which has been developed and introduced by the Soviets in the past nine years.

In the electroslag process the joint is positioned vertically (Fig. 1) and an arc, not maintained during welding, is used to produce molten slag and metal when starting a joint. Welding is started at the bottom of the joint and progresses upward with the moving welding head and auxiliary equipment. Single or multiple wire or plate electrodes are fed into the molten slag bath that floats on the molten weld-metal pool. The electrodes and welding head oscillate across the joint as they move upward with the water-cooled copper shoes containing the molten materials. The weld solidifies from the bottom up.

Initial heating of the electrodes is due to self-resistance and final heating and melting occur by electrolytic heating in the slag bath.

Although economical and quick handling of thick sections are a decided advantage, the Battelle report lists disadvantages such as hot-cracking problems, notch sensitivity in the heat-affected zone, and difficulty in closing cylindrical welds. Despite these problems, welding technologists have been impressed with the economies of the process and the reduction in capital equipment inventories in heavy equipment manufacturing.

Fig. 1. Schematic of electroslag welding process shows how two thick sections can be joined in a single pass.



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25 Sizes in 0.010 increments, from as small as 0.020 to 0.500" offer a low cost solution to precision jig and internal grinding of small holes. Diamond grains are permanently surface bonded to a tool steel shaft by an exclusive Chrome-Lok process for maximum strength, precision and tool life. Two grit sizes—80/100 for faster metal removal; 200/240 for finishing —all with cylindrical heads.
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CUMULATIVE EDITORIAL INDEX FOR 1960 ISSUES

TOOLING & PRODUCTION Magazine

The number of subjects in which T&P's editors present material in just a few issues adds up very rapidly. Most articles are of lasting interest and have future reference value in solving tooling and production problems.

This cumulative index will build up progressively during each calendar year. Each issue will carry a cumulative index of material contained in all previous issues of the same year, with each January issue carrying the complete index of the twelve issues of the previous year.

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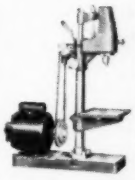

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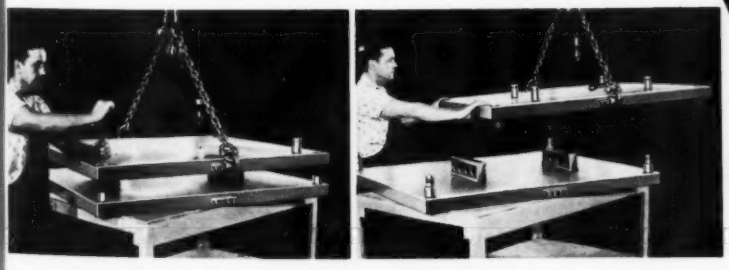

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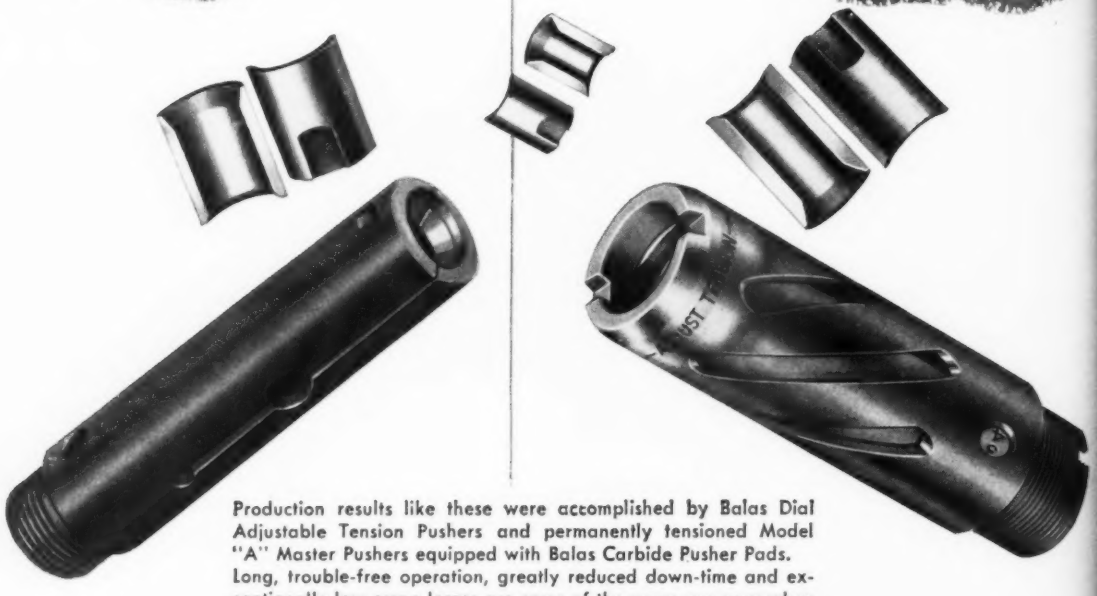

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